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PREFACE

This volume of The Infantry School Mailing List contains material contributed by the following infantry officers:

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TABLE OF CONTENTS

		Page
CHAPTER 1.	Men in battle	1
2.	Terrain appreciation in defense	39
3.	Desert warfare	65
4.	The regiment withdraws	101
5.	A study of leadership and the moral factors of war	121
6.	The scope of machine-gun indirect laying technique	143
7.	Staff personality	175
8.	Limitations of tanks	183
9.	Defense against mechanized attacks	203
10.	Antitank defense in foreign armies	233

CHAPTER 1

Men in Battle

The Historian speaks:

Russia had collapsed. Thus large German forces were freed for other uses. These Germany concentrated in great masses of maneuver on the Western Front. There she proposed to secure a decision. By using the finest army the world had ever seen she would overwhelm France and England in a series of gigantic offensives before American intervention became decisive. Hence, in late March 1918, she struck the first blow. On a front of 50 miles the British received the impact. The line shivered, then broke and the Germans advanced some 40 miles. Quickly thereafter came another blow on the Lys which penetrated the front to a depth of 10 miles. Things were moving fast.

Then, while the allied high command were waiting tensely for another blow against the British, who were "fighting with their back to the wall," the Germans did the unexpected. With lightning-like rapidity they struck a smashing blow at the French. It was almost paralyzing in its effect. From the vicinity of the famous Chemin des Dames, between Soissons and Rheims, on a front of 40 miles the grey-clad German infantry drove rapidly forward 36 miles to the Marne where for the moment they were stopped. (See Figure 1.)

Thus in a short time the Germans had created two giant salients in the allied line both aimed at Paris. Still the tremendous blows continued. The Germans had the initiative and seemed to be able to break through at will. How much longer could the Allies resist the tremendous pressure on their overtaxed lines?

In the Marne salient the Germans continued to mass their forces and hammer at the side toward Rheims in an effort to widen the pocket which was so narrow as to endanger the safety of the army.

Both French and British were reeling from these gigantic blows. The allied morale was ebbing fast. Th crisis of the war was at hand.

What to do?

The American Commander in Chief speaks:

"The Marne salient was inherently weak and offered an opportunity for a counter offensive that was obvious. If successful, such an operation would afford immediate relief to the Allied defense, would relieve the threat against Paris and free the Nancy Paris Railroad. But, more important than all else, it would restore the morale of the Allies and remove the profound depression and fear then existing. * * * as early as June 23 and again on July 10 at Bombon, I had very strongly urged that our best divisions be concentrated under American command, if possible, for use as a striking force against the Marne Salient * * * ."

"General Petain's initial plan for the counterattack involved the entire western face of the Marne Salient. The 1st and 2nd American Divisions, with the 1st French Moroccan Division between them were employed as the spearhead of the main attack, driving directly eastward, through the most sensitive portion of the German lines to the heights south of Soissons." (Figure 2.)

THE CONCENTRATION

The Regimental Staff Officer speaks:

Upon being relieved from the front lines the regiment was ordered to organize and hold a part of a second position along the line Montreuil-Druisy. Although the regiment had been withdrawn from the front lines it was in no sense of the word at rest.

Replacements were received in the line. They had had

practically no training in the art of war. They did not know how to use the rifle, and it was necessary to teach them to adjust the gas mask. But to offset this the regiment had a great asset. There was the nucleus of old regular soldiers of the regiment. Most of them were non-

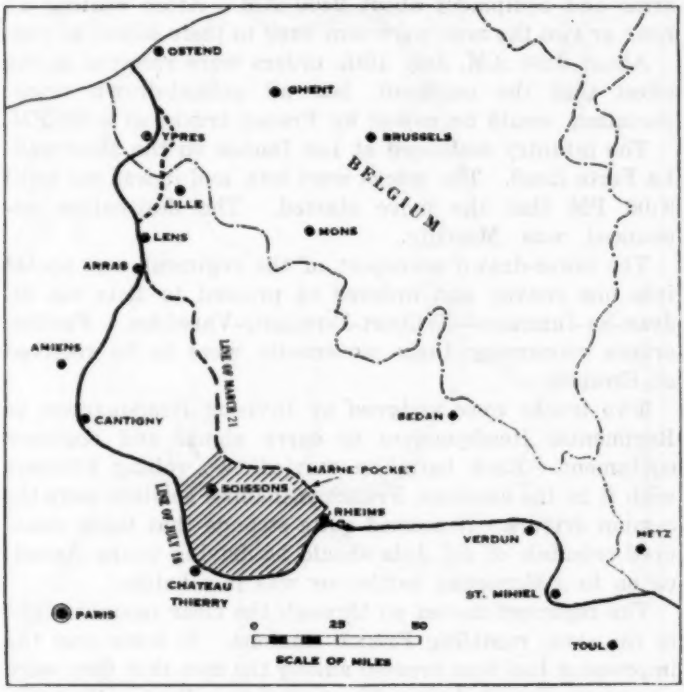

FIGURE 1.—The Western Front July 1918.

commissioned officers. Under them the newcomers soon learned a few of the ways of the infantryman at the front and, better than all, caught the spirit of the regiment. The field officers were from the regular army. Most of the others were young officers who had just come into the service for the duration of the war.

Regardless of all else, the regiment possesed the greatest asset possible—morale.

The regiment was carrying out the mission of holding the second battle position, when at midnight 15-16 July, orders were received requiring readiness to move at a minute's notice. Units were notified and turned out under arms and equipment about 2:00 AM. After waiting an hour or two the men were sent back to their billets to rest.

About 8:00 AM, July 16th, orders were received to the effect that the regiment, less all animal-drawn transportation, would be moved by French trucks at 4:00 PM.

The infantry embussed at Les Dacids on the Montreuil-La Ferte Road. The trucks were late, and it was not until 9:00 PM that the move started. The destination announced was Marcilly.

The horse-drawn transport of the regiment was pooled into one convoy and ordered to proceed to Betz via St. Jean-les-Jumeaux—Trilport-Fermigny-Vareddes. Further orders concerning their movements were to be received at Etrepilly.

Two trucks were assigned by Division Headquarters to Regimental Headquarters to carry signal and engineer equipment. Each battalion carried two rolling kitchens with it in the camions. French Annamite soldiers were the camion drivers. It seemed quite strange that these slant-eyed orientals of old Asia should be driving young America on to a European battle—or was it a battle.

The regiment moved on through the clear moonlit night in the slow, rumbling French camions. In some way the impression had been created among the men that they were moving to a much deserved rest area near Paris. Probably the wish was father of the thought, for thus it is in war that many rumors turn into firm beliefs.

Crepy was passed. It aroused some suspicion. It looked too deserted for such a large town. At so late an hour of the night a lifeless appearance would seem natural in any town; but—somehow this one seemed as if it were not far from the front. It was not normal. Still the belief prevailed that a rest area near Paris was the objective.

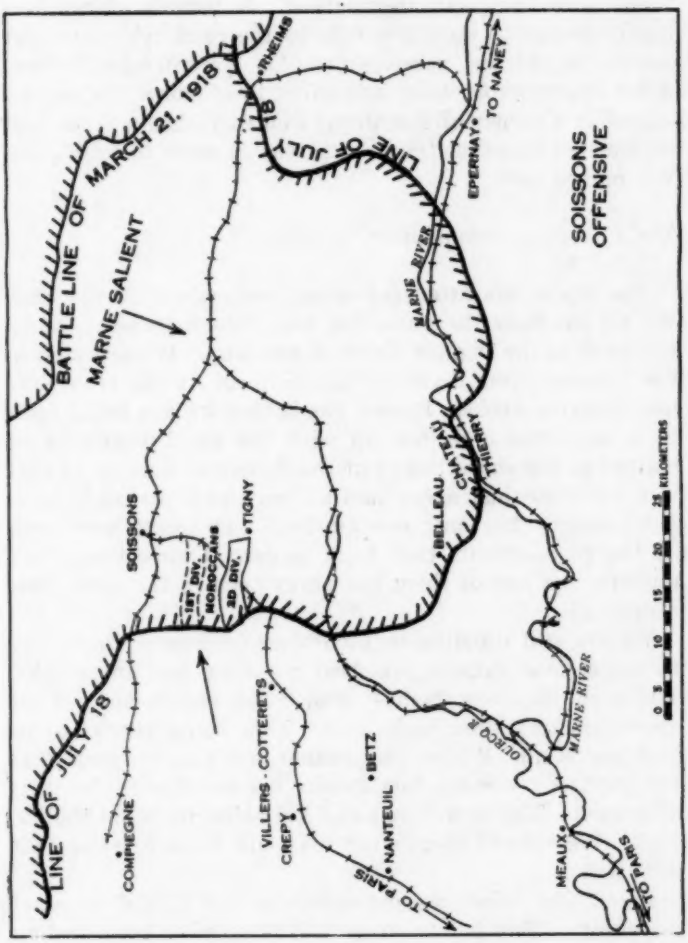

FIGURE 2.—Plan for reduction of Marne Salient.

When the regiment arrived at Marcilly no one could be found who knew our destination. A French officer was finally located in an antomobile by the road, who said that orders would be received at La Fontaine-les-Nonnes. After considerable delay and effort the Colonel did find an officer in a corner of this town, who furnished a guide and informated him that the column was to move to La Plesne. We moved out.

The Company Commander speaks:

July 15.

The Boche are attacking today, somewhere to the east. We do not hear the guns, but the French liaison officers tell us it is the biggest drive of the war. We are alerted for a move. Our division has been out of the front line now for two weeks. Rumor has it that we are going back to a rest area and join up with the 1st Division to be trained as the shock troops of the American army. In that last scrap we just about had all the shock we could take. My company has only one hundred and eighty men with all the replacements that I am to get. I have three lieutenants, and one of them has never been in the front line.

July 16.

We are still standing by for orders to move. They issue us some good rations, the best we have had in months. The men fill their bellies with good red meat and sit around licking their mess kits. This being shock troops isn't bad at all. Whitey, my runner, got a pretty good feed for me too. We are told trucks are coming for us this afternoon. The men smoke and kid about us being the hot stuff. We showed them what we could do to Fritz in that last fight.

About five o'clock we get orders to fall in and we start marching. This is not so good. They have been fooling us about those trucks. The men begin to grumble so I have Whitey and Ryan start a song. It goes slow at first but soon we see a string of trucks parked for miles along the road. Boy—the song goes over big. We climb aboard

just as it is getting dark. Lamb, Baker, Yale and I get in with the other officers of the battalion.

The camions start rolling and we laugh and joke about what a time we are going to have back in the rest area. We ride for hours. The drivers are Frenchmen and do not know where we are going. They follow the truck ahead. We hope they don't take us in the wrong direction. If we are headed for Paris we should be seeing the lights by now. Maybe they don't allow street lamps because of the air raids. Well—we could take Paris, even in the dark.

The Regimental Staff Officer continues:

A little after daybreak we arrived near the western edge of the Foret de Retz. The bright summer sun had begun to pick up the mist and peep through the great trees of the forest. It was quiet, serene, and peaceful. Only the humming of an airplane, so far overhead that its marking could not be distinguished, gave a sign of the nearness of the front lines.

A French officer was located, who said that he knew the regiment's destination. He directed us along a road running north into the forest. So the regiment marched along this route for about an hour, only to learn from another French officer that we were going in the wrong direction. A countermarch was executed back to the starting place. Here a road running easterly into the Foret de Retz was taken. The counter-march, as usual, did nothing to help morale.

The forest, which had been a royal hunting ground in past days, was magnificient with its towering trees. It looked cool and restful. One could not help but think that any place in it would make an ideal camp site. Many paths ran off from the road, as they do in most French woods. The road, itself, was of dirt. It would have been of sufficient width for two-way traffic had the sides not been so soft.

After a few hours the hot July sun became most oppressive. It was extremely hot and sultry. The walls, made by the towering trees on either side of the road, seemed to cut

off every breath of air. It was damp and muddy underfoot. All this added to the all-night ride in camions and the lack of breakfast, began to make the journey acutely uncomfortable. There was no place to obtain water. This would be hard on the new replacements who had not yet learned to conserve the contents of their canteens.

The march became more and more trying. It is easily imagined how hard it was on those men who had been in the trenches for more than a month. They lacked sleep, food, and water. They were marching on a slippery, muddy road on the hottest kind of a July day.

Until a little before noon no other troops had been seen. Only a staff car now and then ran the foot soldier off into the ditch.

Some tanks were passed, parked in the woods on the side of the road. The idea that a rest area was the objective began to vanish. Then some light artillery passed. As the column moved on, the roads became jammed with tanks, trucks, artillery, and infantry. The whole place fairly seethed with men, animals, and materiel.

The colonel had met the division commander about 10:00 AM, and returned to urge the column on with all speed.

At 12 noon, July 17th, the regiment halted by the road for a rest. It was here that news was received that an attack was to be made. Nothing had been known before. Little was known now except that an attack was to be made at daybreak the next day from the eastern edge of the forest (See Figure 3).

By 4:30 PM, the entire regiment had reached Division Headquarters at Carrefours de Nemours. The battalions were moved off into a clearing just to the north of the crossroads, whence they took cover in the forest.

The machine guns, Stokes mortars, and 37-mm guns had not yet arrived. The men carried only 100 rounds of ball cartridges in their belts. They had neither hand nor rifle grenades.

In the meantime the regimental commander had returned to Division Headquarters. Maps (only enough for the regimental and battalion commanders) were secured, a

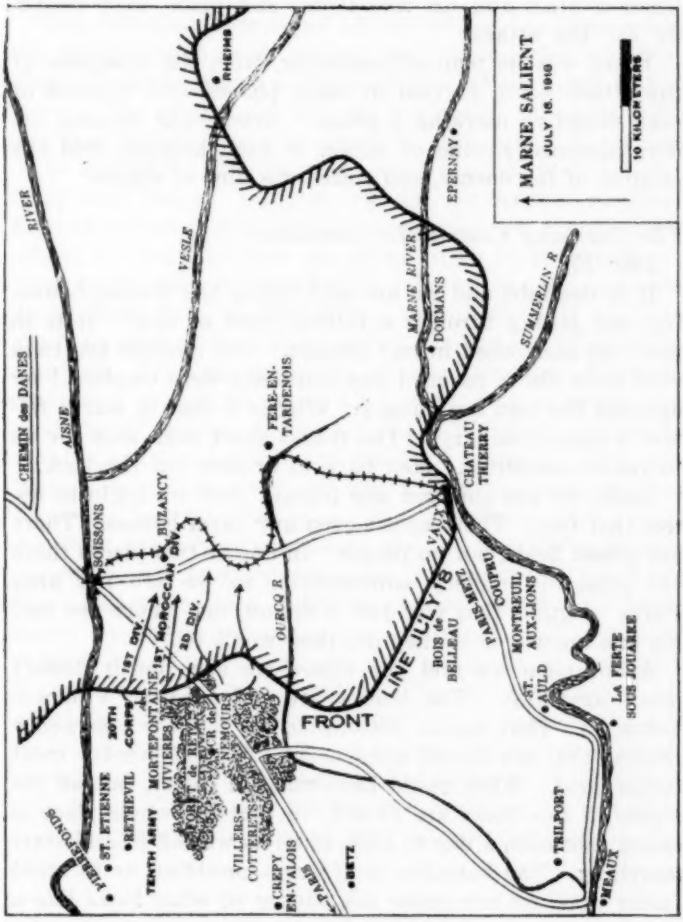

FIGURE 3.—The critical point of attack.

conference was held with the artillery commander, the Chief-of-Staff and his assistants, and plans were drawn up for the attack.

There was no plan of maneuver, with the exception of the attack being carried in three phases—the capture of each objective marking a phase. Briefly the division orders assigned a zone of action to each brigade, told the location of the enemy, and stated the time of attack.

The Company Commander continues:

July 17.

It is daylight and we are still riding the trucks, bouncing and jolting through a rolling cloud of dust. It is in our eyes and caked in our throats. Our nostrils are twin mud holes above parched lips; canteens were emptied long ago and the men are hungry. Why is it that in war a fellow is always hungry? The trucks don't even stop for us to relieve ourselves. Men have to urinate out the back.

Lucky we are not near any towns. And we begin to notice that fact. There aren't even any farm houses. There are wheat fields, but no people. In one or two places there are piles of artillery ammunition, so we are not near Paris. I guess that was just a dream, but where are we? No one knows, or if they do, they won't tell.

About noon we find out where we are, but it doesn't mean anything. The trucks are unloaded at Villers—Cotterets. That means nothing to us, but the emergency rations that are issued mean a lot. The old monkey meat tastes good. Wine would have made it better, but all the stores in this town are closed. In fact the whole place is empty, not even a dog to bark at us as we fall in and start marching. The battalion staff keeps prodding us to move faster until we are under the shelter of what looks like a large forest.

Then word comes to get off the road and fall out. My outfit hits the ground so hard the rattle of their mess kits could be heard a mile away. They are asleep in two minutes. Just as I have a nice nest of leaves fixed for myself,

a battalion runner tells me to report to headquarters. All the company commanders are there.

The battalion operations officer tells us to take notes. He fumbles with some papers and I notice that all of us seem strained. We are listening—for what? And then I know! We all feel it. We are not in any rest area. We are near the front and we listen for the guns. Every one of us is ready to dive for cover when the first shell arrives. They can't fool us. And sure enough, the operations officer tells us we are to take part in an attack. He doesn't know when, but soon. There are going to be tanks, which we have never seen before, and he tells us to keep our men away from them so the enemy fire won't hurt us. He reads us a lot of junk about rocket signals and other pyrotechnics. A yellow smoke for this and five stars for that, and every one of us knows that there isn't so much as a Very pistol in our whole battalion. We don't even have enough ammunition for ten minutes' fighting. The men heaved most of it away last night, thinking they were on their way back to a rest area. The operations officer reads on about artillery preparations and the like. Why do people write such long winded trash that means nothing? We light cigarettes, look solemnly at each other and listen again for the sound of guns.

Soon we return to our men and get them to their feet. It is no mean accomplishment. The men don't know yet about the attack, but they don't believe in Santa Claus any more. They know we are not going to a rest area as we plod doggedly through the gathering darkness of the forest.

It is six o'clock and another halt is called. The rolling kitchens have arrived somehow and the men line up for food.

The Regimental Staff Officer continues:

Before all of the troops had arrived at Carrefour de Nemours the field order for the attack had been written. It was based on the orders of the division and was in substance as follows: (See Figure 3A.)

The enemy holds the line through the eastern part of

the Bois de Retz from near the Trench de Bade, along the Laie Grande Veneur to Carrefour Aumale, thence to Carrefour-du-Conservateur. The allies attack in the direction of Fere-en-Tardenois, 1st Division on the left, 2d Division on the right, and 1st Moroccan Division in the center of the 20th Army Corps on "S" day at "H" hour.

First objective, a north and south line through Beaurepaire; second objective, a north and south line through Vauxcastille; and third objective, a line just east of Vierzy. (A rough sketch was attached to show zones of action and objectives.)

The regiment will move at 8:00 PM tonight and take up positions for the attack in three echelons, from front to rear, 2d Battalion in advanced trenches now held by French in front of position to be assaulted; 1st Battalion in vicinity of Chavigny Farm, and 3d Battalion in eastern extremity of Foret de Retz.

All three echelons will move off in the attack, which will be preceded by a large number of tanks and follow the barrage at 300 meters.

Each soldier will secure two extra bandoleers of ammunition when passing dump on the way to the front tonight.

Advance P.C. of Regiment at Chavigny Farm.

The 3d Battalion (Reserve) was ordered to furnish one company as a combat liaison group to operate on the right of the assault battalion.

The first feature which strikes one is the zone of action which changes abruptly 45 degrees to the right at Beaurepaire Farm.

There was to be no artillery preparation. At 4:35 AM, fire was to be opened without previous registration.

As we see from the orders, little or nothing was known, or at least divulged, concerning enemy strength or his dispositions.

At about 4.30 PM battalion commanders and staffs assembled and orders were issued. The Majors were able to secure only one copy of the map, since no more had been given us. Imagine their difficulties in giving orders.

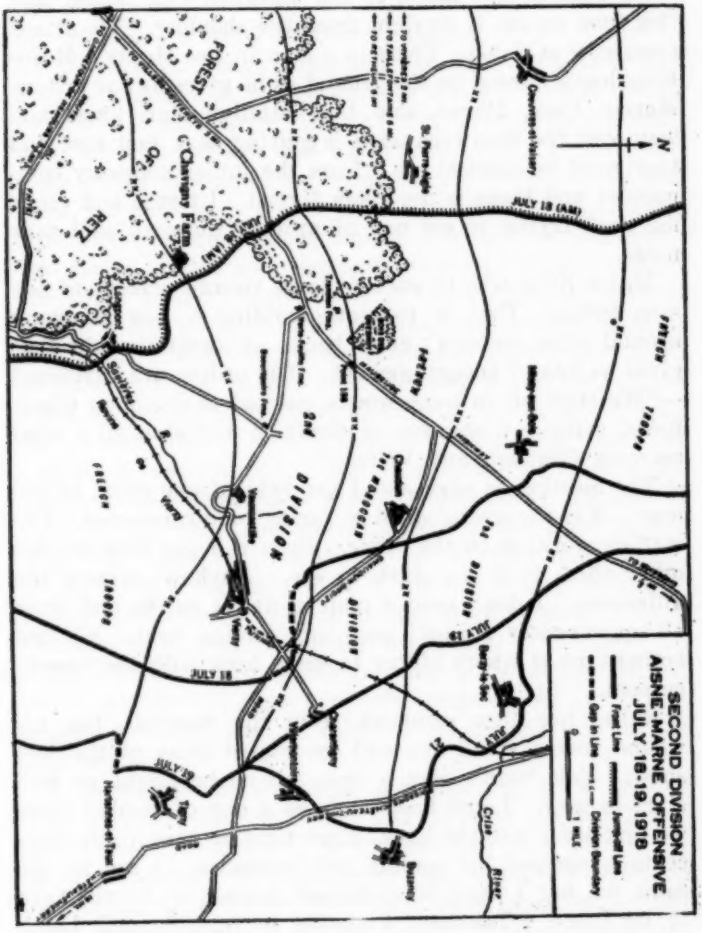

FIGURE 3A.—Zone of advance.

The Company Commander continues:

All officers are called to the battalion commander and this time we get it straight from the shoulder. We attack tomorrow at dawn. There is a map in two sheets. Major King has it spread on the ground as he gives us our orders. Morris, Cass, Doran, and the battalion staff kneel and lean over the map because it is getting dark fast now and they must be close to see. I am the junior company commander and there is not room for all. I tiptoe and crane my neck trying to get one glimpse of the map as I take notes.

Major King tells us each to leave twenty percent of our men behind. That is to start building a new company around when we don't come back. A sweet thought that gives us lots of encouragement. The orders are furnished —"We start off in some woods, get out in the open wheat fields, make two changes of direction and stop on a road between Chaudun and Vierzy."

The meeting is over and I get hold of one sheet of the map. It is the wrong sheet as far as I am concerned. The staff is working on the other. Even if I got hold of that other sheet it is too dark to see. Anyhow—what's the difference. I don't need a map to find a battle, and from all appearances I won't need any coming back. All that bothers me is which officer to leave back with the twenty percent.

Baker has just returned from the hospital, but his wound was a small one and he missed most of the last show. Yale hasn't seen a fight yet so he might as well start in now. Lamb hasn't missed a day of combat since we first went into the lines. Each time he goes in, the percentage against his coming out increases. I am in the same fix, but I can't leave myself behind, so it will have to be Lamb. The men I choose to remain with Lamb seem dazed. Death has passed them by once more and they will be alive this time tomorrow. They turn away without farewells so we others won't see the relief on their faces. We fall in and start marching.

THE MARCH TO THE JUMP-OFF

The Regimental Staff Officer continues:

The regiment, with battalions in order in which they were to attack, took up the advance about 9:00 PM. Rolls were left behind under guard. The stripped pack with rifle belt and bayonet was carried.

All of the afternoon the roads were becoming more and more jammed with traffic of every description. There were huge French camions loaded with ammunition, artillery, tanks, ambulances, machine-gun carts, and foot troops. One could hardly imagine how so many men and animals and so much materiel could be assembled in one place in such a short time. But were there not 67,000 men, 5,000 animals, and 300 vehicles concentrating in the forest, who would within 10 hours be attacking? The great artillery fire, which was to be executed, called for countless rounds of ammunition. Every minute the jam grew worse. The infantrymen were already being shoved off into the ditches. The underbrush was too thick in the forest for marching. It seemed as if utter chaos would result, if, as a matter of fact, it did not already exist. It was as if the water of Niagara had tried to pass through a garden hose. Dark came and it commenced to rain.

The strictest march discipline was to be maintained. It was forbidden to light a cigarette. Silence and every precaution were required to keep the enemy unaware of our approach.

A terrific electrical storm, accompanied by a driving rain, added to the confusion and to what seemed insurmountable difficulties. The imagination can hardly be stretched enough to conceive of the situation. Nothing was visible at a pace. The men were drenched. They were forced to march in the muddy ditches beside the road. Now and then even this route was obstructed by a mule, or a truck, or a caisson, which had been shoved off the road. It was necessary to form a column of files which seriously elongated the column. To avoid having men lost, orders were issued for each soldier to hold on to

the man in front. When a break occurred in the column a halt was called until the break was closed. Otherwise the end which had broken off would have been lost. It was next to impossible to find one's direction. There was a perfect network of roads. The darkness and rain prevented location by map. The only hope was to read the signposts. The battalion commanders were the only ones who knew the way. The others had had no chance to make a reconnaissance. The lightning was about the only circumstance in favor of the struggle to get forward. By its flashes some observation could be obtained. This intermittent brilliance helped considerably.

The Company Commander continues:

We fall in and start marching. It is soon necessary to walk in single file. A whole French army must be coming out on the same road we use going in. Tanks, trucks, cavalry—are they retreating? We squeeze past each other with no words between us. To make the task more difficult it begins to rain—a regular cataract with crashing thunder and jagged lightning. Clinging to the belt of the man ahead we plod on and on, soaked to the skin. The mud becomes a slippery and treacherous paste on which many of us measure our lengths. Some slide off the shoulder and flounder about in a deep ditch until pulled out by others. Heads down we struggle on; a long, tortuous column of gnomes, steeped in misery. It is after midnight before we become indifferent to the elements, or our own wretchedness, and the fate we know we are going to meet.

The Regimental Staff Officer continues:

The adjutant reported to the regimental commander that all battalions had passed the ammunition dump at which he had been posted. Lieutenant Warner of the 3d Battalion had put down his gas mask to help issue ammunition. The sergeant next to him picked it up in the darkness and issued it as a bandoleer.

The men were moving on the proper routes but the

French were sending in the most disquieting reports to the effect that our troops were lost in the woods.

At 3:30 AM, the sergeant major of one battalion reported to the regimental commander that two companies of his battalion had been lost in the woods, and that he thought only a small portion of the battalion had reached the jump-off position. The regimental commander personally took charge of the two companies and led them to their position. A French guide had led the regimental headquarters astray, but it got back on the right path and came out of the forest at the proper time and place. About this time a battalion of marines passed the P.C. It seemed impossible to expect that an attack would have any chance to succeed under these mad conditions.

At 3:15 AM, the troops of the 2d Battalion began to march in double time in order to get to their position. The French guides were insufficient and practically of no value. About 4:15 AM, the 2d Battalion began to run into French troops moving rearward. At 4:30 AM it arrived at the jump-off line—only five minutes before it was to move off into the attack.

The other battalions had practically the same experience in getting to their positions.

The other regiment of the brigade had been more fortunate so far. It had arrived at its jump-off position early in the night.

The 5th Marines on the left of the brigade were a little late in getting to their jump-off position. They were deploying when the enemy barrage fell, and began their advance twenty minutes thereafter.

The accomplishment of simply getting to this fight was a great feat all by itself.

The Company Commander continues:

July 18.

The rain continues through the night and then ceases just as the first crimson dash of dawn splashes through the trees. We march down a sharp incline and over a road paved with cobble stones. I turn a corner and look down

an aisle of foliage. Major King with his staff is standing by a pile of ammunition boxes in the middle of the road. We form in column of twos, each man receiving a bandoleer of sixty rounds as we file by.

"Better hurry up," Major King suggests, "It's a mile from the front line, and it's four-forty now."

"What time is the attack?" I ask.

"Four-fifty."

God Almighty! A mile to go in ten minutes after marching all night! The Major presses a French soldier onto me for a guide. Somehow we shuffle into a double time.

THE BATTLE

The Commander in Chief speaks again:

"The advance began on July 18th, without the usual brief warning of a preliminary bombardment."

The Regimental Staff Officer continues:

Exactly at 4:35 AM, the zero hour, as the gray dawn was just breaking, the powerful artillery concentration opened up. The noise was so terriffic that at a pace one actually could not hear another person yell.

No sooner had our barrage come down than enemy rockets went up, calling for their barrage, which came down immediately. So far no tanks had appeared.

Instead of advancing at 100 meters per two minutes, the men began to run forward. Considering what they had just been through, one perceives that their dash and spirit were remarkable beyond description.

The surprise of the attack was complete. Prisoners soon began to stream back. Some wounded were coming in to the aid station of the 3d Battalion near Chavigny Farm.

The Company Commander continues:

Five, ten minutes, and we are still lumbering heavily down the road. Then all the guns in the world go off at

one time. It sounds like heavy canvas being ripped from sky line to sky line, followed by a mad beating on the air. We start to run in earnest. No one can lag behind when the whole world is being torn to bits.

We catch up to the tail end of "G" Company on a curve in the road. A shell lands and there is no more tail! The Germans are shooting back. My guide dives into the woods on the left of the road and disappears like a rabbit. Last night the major had said my company would attack on the right side of the road and here is the guide taking us to the left. But we can't stay in the road so I turn to the left along an old trench. The guide is gone. I yell but nothing can be heard above those guns. I see a dug-out and jump down in the trench to look inside. I find two French officers, one a doctor, huddled in a corner. We cannot understand each other.

"Boche," says one and points toward the front.

I climb out and am nearly knocked down by Baker charging through the woods.

"The battalion on the left is advancing," he screams.

God dammit! I get mad. This is no way to conduct a battle. No information, no map, no guide, nothing. Hell's fire, what do they think I am? A mind reader?

"The outfit on our left is getting out of sight," someone passes the word down the column.

"Right face," I yell, waving my arm, "Forward."

The attack is on, but what a way to start a battle. Baker and I rage up and down, forming the company into two waves. I put Yale in charge of a third line of moppers-up. They have orders to keep an eye up on the trees and to fire a burst of fire into any thick bunches of leaves because there will be snipers there. I also tell them to push six inches of steel into any Germans lying on the ground. If they are dead it won't hurt them and if they are alive it will discourage them from getting up and turning loose a machine gun in our backs.

With the company organized and going good I investigate our right flank. It is moving along a road and the woods on the other side look deserted. I jump into the

road and dive back into the woods. A fistful of bullets come right in after me. Man—that's bad business. Our right flank is in the air. I leave Baker in charge there and go over to see who is commanding the outfit on our left. It is Wild Bill Carney and I find him behind a tree, whanging away with an automatic in each hand at a Boche sharpshooter. He doesn't leave his sport until I grab a man with a Chauchat and have him bust that Boche out of a tree. I ask Carney how the rest of his battalion is getting along and the dam fool tells me he hasn't seen them since last night. When my outfit came in on the right he thought that was the signal to jump off and here he was and his left flank was hanging in the air just like my right was.

Suffocating smoke screens! I'd like to knock the silly grin off his face with my automatic—shooting duels with German snipers! But as long as it's him and me against the whole German army I guess we better stick together. Besides he's senior to me. We cross a small swamp and a lot of wind-falls and trees knocked down by shells. There has been a machine-gun nest here and a few go off like dying locusts until they are stamped out by our men. There are some more off to the right that resist with more vigor, but Baker and Whitey find a box of German stick grenades—we have none of our own—and we all take turns unscrewing caps, pulling cords and returning the Berlin hardware to the original owners. We are soon able to move on and come to the edge of the woods. A vast expanse of wheat fields stretch out ahead of us. Except for two little towns on the horizon those fields are as empty as the sea.

The Regimental Staff Officer continues:

The attack moved forward rapidly across the great wheat fields which stretched as far as the eye could reach. The wheat was about the height of a man's chest. On the right of the regiment was a wooded ravine, running parallel to the axis of attack. Wounded men passing regimental

headquarters reported that the attack was going well, that the advance was so fast at times that one could hardly keep up with it.

At 5:00 AM, regimental headquarters was established in the ravine near Chavigny Farm. Prisoners continued to arrive. At 5:30 AM, a division staff officer arrived to take notes on what happened. He left shortly afterward. This was the last that was seen of any of the higher headquarters for some time.

A photographer from division headquarters started out, but, having left his plates behind, soon decided that he would have to return for them.

Messages began to come to the Post of Command of the regiment. At 6:28 the other regiment of the Brigade reported that everything was going well, and from that time on the closest contact was maintained between the two regiments by runners.

At 6:30 AM, the Commanding Officer of the 1st Battalion reported that the advance was progressing all right.

About 6:25 messages from assault units reported that the first objective had been taken at 4:50 AM. Three kilometers had been covered in 20 minutes.

The fight around Beaurepaire Farm, while it did not last long, was, nevertheless, severe. It was well defended by trenches, and machine-gun fire swept the open fields to the front. Casualties were quite heavy.

The 9th Infantry took the Farm itself, as the 23d Infantry was coming up on the right.

After all the confusion of the night before, things began to brighten. The most stubborn resistance was being overcome by the doughboy equipped only with his rifle and bayonet. The artillery barrage until this time had been excellent.

The enemy barrage consisted mainly of concentrations on the approaches; although a thin barrage was passed through in the open. A great deal of air-burst shrapnel was being used.

The advance had been pushed where the going was good.

In this process of infiltration enemy islands of resistance were still holding out, at times, as far back as 500 yards behind the assault lines.

In attacking Beaurepaire the assault and support companies of the 2d Battalion had become intermingled. Even parts of the 1st Battalion were getting up into the front line.

At Beaurepaire the direction of attack changed about 45 degrees to the right. Even after the most frantic efforts of the officers, parts of the battalion continued in the original direction, going over into the sector of the regiment on our left.

A change of direction by an assault unit under the heaviest fire, the impossible, did not daunt them. On they drove. The more the opposition, the harder they fought One wondered what forces could spur human beings on to such heroic efforts. There were some who straggled and dropped back, but they were few. The courage and self-sacrifice, displayed by the individual and the whole, were an inspiration.

At 6:45 AM, the post of command of the regiment moved to Beaurepaire Farm.

Some of our artillery was already moving forward at a gallop in the fields east of Beaurepaire.

French tanks were moving up under heavy enemy artillery fire, which succeeded in knocking out several of them. They were mostly the larger type of French tank.

The first objective (Beaurepaire) having been taken, the attack shoved on. The resistance became more and more stubborn. From here on contact with the 38th French Division had been lost. It had fallen behind the cyclonic attack of our troops. Provision had been made for this. Company L, 3d Battalion, had been detailed as a liaison group on the right of the division.

The fighting became terrific around the precipitous banks of the wooded Vauxcastille ravines. The ravine would have been extremely difficult to cross even when not under fire. But a perfect network of machine-gun

nests covered the ravine and open fields to the east with flanking fire.

Baron Richthofen's famous "circus" paid a visit about this time. These salmon colored planes came swooping down extremely low over the infantry. They used their machine guns, and threw bombs over the side at the infantry. Although few casualties were inflicted, they were a bit troublesome. The orders were that they shouldn't be fired on by riflemen lest positions should thereby be revealed. Everyone was to lie motionless, face down. However, these orders were not strictly carried out. Enemy aviation remained very active throughout. Few allied planes were seen. There were no infantry contact planes. Germany mastered the air as far as the doughboy was concerned.

The 2d Battalion reported that the crest overlooking Vierzy had been reached some time between 9:00 and 9:30 AM. Our troops were on the north, west, and southwestern approaches to the town.

Captain Hart sent a very laconic message about this time. His company was held up in front of Vierzy. As well as it can be remembered, it contained three words "Shoot up Vierzy".

The second objective had been captured after an advance of six kilometers of hard fighting. In this rapid advance many machine guns and prisoners had been left behind. Units had become badly intermingled. It was necessary to clean up and reorganize.

The Company Commander continues:

We hate to leave the safety of the woods and get out there in the open. Carney and I look at each other and then start out together. He goes straight ahead and I turn half right.

"Hey," he hollers, "You're going in the wrong direction."

I look at the notes I took last night and tell him we have to take a change of direction here. Carney hasn't got any notes so he decides to take my word for it. Any

argument is prevented by a cannon going off right in front of us. An invisible fire engine screams right over our heads and knocks down a tree just behind us. A German field piece is hidden in a fold of the ground not more than a hundred yards away. Our men have never captured an artillery outfit in action and it is a foot race for souvenirs with Wild Bill in the lead. The gunners are trampled to death in the rush. Our men are all tangled up around the gun positions. There are three guns, two having been put out of action by our own artillery. Wild Bill is waving a pair of German field glasses over his head. Whitey is pulling my arm and pointing over to the right. He is so excited I can't understand what he is trying to say. I look where he points and my heart does a tumblesault. Three tanks come bobbing up over a hill toward us. Grim, ugly little ducks, dipping and waddling through the waist high grain. The men begin to huddle together and look at me with fear on their faces. Well, I'm scared too. I don't know how to fight these things. And then I see men following the tanks and I know it's all right. Joe Morris is there with G Company, and further over is Cass with E. We line up with them and it's like a Sunday stroll. The tanks lead, we are all together and the Boche seem to have beat it. We cover two kilometers without firing a shot. Then darned if we don't run right into the rear of another regiment of our division. They are held up by machine-gun firing from a walled farm. Our tanks waddle over to take a hand. An airplane flies over and signals "Where are you?" We have no signal lights to answer with and send runners over to the French on our left to borrow some. The airman doesn't wait, but drops smoke and turns our own barrage on us. We back up and send frantic messages to lengthen the barrage.

Two of my men have been hit by our own shells. I'd like to have a long range shotgun and I'd fill that goddamn aviator full of buck shot. To make things worse some machine guns open up on our left. There is a deep ravine ahead and it's full of Boche. Baker and I go

after them, some Algerians go after them. The 9th and 23d Infantry and the Marines all go after them at once. We are all mixed up but we get the guns. Then we see some more Germans sneaking up the ravine to the left. We all take after them, too. Some are captured and some run. We follow, up to the end of the ravine. The Germans cross a field into a small town. Some Americans hit the other side of the town and the Germans come out again. They dive into a trench and my outfit goes after them. We root them out before they can set up their machine guns. A big Hun shows up from nowhere and comes right at me with a bayonet that has saw teeth all down one side. I try to get my automatic out of its holster, but I'm too slow. I close my eyes so as not to see the steel go into my belly, but nothing happens. When I open my eyes I see Whitey, my runner, trying to pull his own bayonet out of the German's side.

I'm weak all over and sort of soaked with sweat, but the Boche are getting out. They run through the wheat and out of sight down a hill. The men would have followed, but I hold them back. I want to check up. Over on my right some French troops are coming into the trench. I walk down to the left. We are on the crest of a plateau looking into a deep valley where a river must flow. Indirect machine-gun fire is coming from 'way across the valley and I make the men stay in the trench. Me, I don't think they have my name on any of their bullets, so I walk on top. The men know I'm not showing off—just feeling my oats. They look up at me and grin. I haven't lost more than a dozen men altogether and they know it. They want me to know they are with me because I am with them. And then I see some fellows who don't know who I am and care less. They are tired and have had a tough time.

"Hey," I say, "What outfit are you from?"

One of them looks at my insignia and tells me they are what is left of the 18th Infantry. Leaping toad frog—the 1st Division! And this is the rest area where we were to meet them!

But what the hell are they doing here? They are supposed to be miles to the left of our division with a French division between us. I look around. Our objective was a road between Vierzy and Chaudun. Well, I am standing on a road, with a town to the right and one to the left. They have no signs to tell if they are the right ones, but they are the only two towns I can see and I can see for miles in all directions. I send a message back to Battalion Headquarters with all the information I have and ask for orders. I look at my watch. It is ten-thirty. By God! I thought we had been fighting for a week at least. Most of the men have gone to sleep. Others are looking forlornly amongst the dead in hopes of finding some rations. I wish I had something to eat too, but I haven't. Then my messenger returns from the Major with instructions to hold my present position until further orders.

Gee, I'm hungry. I ask Whitey if he has any grub and he nearly cries at the thought. I have cigarettes so we each have one and then I go to sleep.

The Chief of Staff of the German Seventh Army speaks:

Not the slightest intimation reached us that any attack was coming from the southwest toward Soissons. Notwithstanding this, shortly after 5:00 AM of July 18th hell broke loose along this sector. A terrifying artillery fire deluged us and extended as far as the adjacent sectors. Only one hour later, all telephone wires west of the line: Berzy—Villemontoire—Hartennes collapsed. Air reconnaissance soon convinced us that the enemy meant to execute his major offensive here. Not until another valuable hour had passed—it was 7:00 AM meanwhile—were we able to discern that the enemy had succeeded in breaking through our position near Longpont; having occupied Vauxcastille and Moulins de Villers Helon.

We did not yet know the worst. Only after we got reports that strong forces of the opponents had already reached Vierzy did we clearly perceive that our infantry was overrun almost the entire length of the sector, and

that a great part of our artillery must be in the hands of the enemy.

Only in front of the American and Moroccan divisions —and this spot alone—was the enemy succeeding in obtaining worthwhile results. Thus everything depended on preventing this force from driving a deep wedge into our front. Our situation was grave. We might have to evacuate the salient, to be sure, but we needed time to make this strategical retirement. If the Americans took Soissons—and they were not far from it—before this evacuation could be accomplished, *then the war would be over in short time.*

We must hold Soissons!

If our supreme command delayed matters for even a few hours, it would be too late; we would lose any chance of stemming the enemy tide west of Soissons.

But there was no delay. Orders were quickly issued to line up our divisions from Chaudun to Vierzy and west of Blanzy. New artillery was ordered to move in.

If we could hold Soissons until night we could in all probability hold it until we completed an evacuation.

It was a race against time. Would the Americans, who had plunged so deeply into our lines, storm Soissons before our defensive measures could be completed?

The Regimental Staff Officer continues:

All day desultory fighting kept up around the Vauxcastille ravine and Vierzy.

Some of the wounded were bringing the most alarming reports. Man after man claimed that he was practically the last of his platoon, in command of which he had fallen.

The 1st and 2d Battalions had become intermingled. Parts of the 1st Battailon had been fed into the 2d Battalion throughout the day.

There had been no communication with higher headquarters until this time. Within the regiment control and dissemination of information had not amounted to much. Runners were the only means of conveying orders or information.

THE SECOND ATTACK

Early in the afternoon of the 18th, General Ely, commanding the brigade, met General Harbord, the division commander, at Beaurepaire Farm. General Harbord, having been informed of the situation, ordered a second attack to be launched at 4:30 PM. However, this could not be done, for not until this hour could Brigadier General Ely locate the infantry regimental commanders.

The division order was dated 18th July 1918, 1:30 PM, and was in the form of a message to the Commanding General, 3d Brigade. Therefore, due to a deep penetration, and the normal disorder of a great and successful battle, at least three hours had been consumed in getting orders as far as regimental headquarters.

The orders of the division stated that, "Our cavalry, with some infantry and trucks, have been pushed to the front in pursuit of the enemy." Some French cavalry had been seen in the fields west of Beaurepaire, but none had seen or heard of, prior to this time, "pursuing" the enemy.

The 3d Brigade, supported by the 5th Marines and 6th Machine-Gun Battalion, was ordered to make the attack upon receipt of the division order. The attack was to be supported by the Field Artillery Brigade.

The orders of the 3d Brigade were to resume the attack at 6:00 PM, with the eastern extremity of the Bois d'Hartennes as the objective, with the 23d Infantry on the right and 9th Infantry on the left.

The 23d Infantry was ordered to capture Vierzy and push on in the direction of Tigny. Fifteen French light tanks were to support the attack of each regiment. Also one regiment of artillery was to support each infantry regiment.

The 1st Battalion, 5th Marines, was designated to support the 23d Infantry.

Our troops, without food or sleep for 48 hours should be completely exhausted. Yet such things are often deceptive. Despite all, and even though disorganized, the

troops were victorious and still boring in. All of the normal objectives, except the town of Vierzy—a veritable stronghold of machine guns and men—had been captured.

The 1st and 2d Battalions and parts of the 3d Battallion, which now held Vauxcastille ravine, were mixed. The 9th and 23d Infantry Regiments had, themselves, become somewhat intermingled. The remainder of the 3d Battalion was at Beaurepaire Farm.

The French on the right appeared to be fighting for the woods southwest of Vierzy.

It was impossible to start the attack at 6:00 PM. This was the opinion of both regimental commanders. The tank commander wanted more time than the infantry. At this time a French colonel, commanding a cavalry regiment, rode up. It seems that his orders were to break through near Vierzy if our attack was successful.

One could hardly imagine a more impressive sight than this regiment of cavalry in approach formation in the wheat fields west of Beaurepaire. What a comparison there was between them and the doughboys! The cavalryman was superbly mounted, immaculately uniformed, and well equipped. The regiment looked as though it were on parade. The long lances glittered in the evening sun. The doughboy was ragged, covered with mud, his clothes torn. His face was drawn and tense, showing the strain of his hard task. He looked determined, capable, and powerful. And he was.

The Company Commander continues:

Baker shakes me out of my slumber about four o'clock. Baker is dirty, unshaven, hollow-eyed, with mud-caked equipment, and I wonder if I look as bad.

"Everybody has pulled out but us," Baker says.

I think Baker is maybe a little bit cracked so I go in search of the officer with the 1st Division. By gosh they are gone. That long line of helmets that had been bobbing around in the wheat fields like so many iron clad turtles has disappeared. I run over to the right and

find the Moroccans are also gone. My outfit is all alone. Asleep on the battle field! Now I am scared!

I climb out of the trench and look out across the valley to our front. The opposite slope, heavily wooded, rises steep and high, and toward its farthest hill the evening sun is swiftly gliding. Are we going to have to stay here alone all night? I look to the rear and see a lone doughboy, rifle slung over his shoulder, walking dejectedly down an unimproved road. I whistle and he comes at a dog trot. He is a runner from battalion headuarters and has been trying to find me for over an hour and has just about given up hope of locating me. He has orders to guide my outfit back to the battalion without delay.

Baker and I pull our men out of the trenches and get going. As we head for the same ravine we had come up, I see a lone French cavalryman—he and his horse standing behind a small bush. I ask him what he does there.

"Monsieur," says he, "I guard the left flank."

Looking back over the bleak and empty landscape I hope he does a good job of it. He is still there silhouetted against the setting sun, as we wind down into the ravine.

The Chief of Staff of the German Seventh Army continues:

Finally we got our divisions lined up to plug the gaping hole. They held the line Chaudun to Vierzy and west of Blanzy. Our new artillery units were in, placed in effective defensive positions. We were ready; and the 20th Division would arrive tomorrow. But the severe fighting during all the day had proved to us that our exhausted infantry, although repulsing one attack after another, was no match for a numerically much stronger enemy supported by whole fleets of tanks. Could we get by this day?

The Regimental Staff Officer speaks:

The attack jumped off at 7:00 PM and soon reached

the crest overlooking Vierzy. The regimental commander was with the assault waves when the attack was launched. He believed that the time had come when he should personally lead the men. At this stage personal command was absolutely necessary. Other means did not exist. Much of the vigor of the attack is no doubt due to his untiring energy and flair for personal leadership.

The artillery support for the attack failed to materialize, as was to be expected for there was no liaison between the artillery and the infantry. In fact very little existed anywhere—how could it under the circumstances?

The French troops on the right could not be seen. Whether they attacked or not was not known.

In the ravine, just west of Vierzy, was a battalion of Moroccans. How they happened to be there was — and still remains — a mystery.

The tanks moved forward out of the ravine into the open wheat fields to join in the attack of the infantry. As soon as one would debouch it would draw a hail of shells. The Germans were using direct fire from short ranges. It was remarkable how a single tank managed to pass through the fire, but only a few were stopped at this point. They pushed on out to the front of the infantry. The tanks drew so much fire that the infantry ran to keep in front of them, and the tanks went all the faster to get to their proper position in front.

The brigade was advancing in excellent order.

The 1st Battalion, 5th Marines, which was supposed to be in reserve, "shoved off" to an early start and fought its way into the town of Vierzy. When half-way through the 23d Infantry came up and continued the attack. And so Vierzy was captured. The number of prisoners taken ran into the hundreds. The many caves and a large tunnel were literally full of men.

During the day the wounded who had not been found lived in the hope that they would soon be located. In the full grown wheat, which hid them, they did not murmur. But now that darkness was falling their hope of being found was vanishing. They began to cry piteously for

help. One could hear them all over the fields, Germans, Moroccans, and Americans. It was a most pitiful and distressing condition. As many as possible were gathered together near landmarks so that they could be found by the medical personnel. Early in the day the prisoners were required to carry the wounded back. But up until the afternoon the roads were too blocked for transportation to pass and the wounded could not be evacuated any further than the aid station. Medical officers worked until they were exhausted. Every possible effort was being made to get the casualties out. Even ammunition trucks were used, the ambulances having been caught in the road jam.

The manner in which the wounded bore themselves in the midst of their great suffering left no doubt as to the courage of our soldiers.

By 8:30 PM, the attack had passed on to the front of Vierzy. Fast approaching darkness prevented further advance toward Hartennes, the objective. Flares indicated we were in a pronounced salient. However, the line was then within three kilometers of the Soissons — Chateau-Thierry road. The advance was halted and the troops ordered to dig in along a line about one kilometer southeast of the eastern edge of Vierzy.

The machine-gun and artillery fire died down. Only here and there a machine gun would sputter for a moment and then—silence.

The Company Commander continues:

We follow the rock-strewn floor of the ravine, making a wide half moon turn before reaching the spot where the runner says he had left the battalion commander. The runner looks around in dumb amazement. Except for a few dead Germans and various discarded articles of equipment, the place is deserted.

"They're gone," he says brightly.

I grab him by the collar and shake him. I think maybe he is a spy, but he swears this is where the major had said to bring my company. He has done as he was or-

dered and it isn't his fault if the battalion has moved. Maybe if we looked around we could find someone to tell us where they went. We didn't have to look far. A man, badly wounded, suddenly appears on the rim of the ravine overhead.

"Help," he cries, "Help."

He attempts to descend, stumbles weakly, and comes rolling down loosely, like a sack of potatoes. I catch him and ask him where is the battalion.

"We attacked," he gasps, a bloody bubble coming with each word. "The machine guns cut us to pieces."

I go up the side of that ravine as fast as I can. Out ahead are the same monotonous fields of wheat. Through the center runs a narrow gauge railway. Just beyond this, two assaulting waves of Americans are making slow but steady progress. But what they don't see, and I do, is a small group of Germans crawling along my side of the railway. They have two machine guns. If they set those up it will be murder.

"Come on," I yell at Baker and the men.

I see a dead soldier and grab up his gun and ammunition. I load as I run and others are running with me. Baker on one side and Whitey on the other. The rest are coming, too, as fast as they can. We must look pretty grim strung out through the wheat. If the Boche see us coming they will turn the guns on us; but they are too intent on the battalion up ahead. Two hundred yards—a hundred—then they see us! We yell and start shooting on the run. They yell and shoot right back. One of their machine guns is up and they have the most bullets. Lead is cutting the wheat all around us. Some of the men are hit. We can't stop. It would mean death for us all. Those meat choppers would cut us to pieces. I reach them. Baker reaches them. All that is left of the company reaches them. We take no prisoners. Why the hell should we?

"Get them formed up, Baker," I say, "We got to get going."

I look for Whitey. I call his name. I stare at the figure on the ground that answers weakly. That can't be Whitey—not the kid that has followed and stuck by me for months; not the boy who saved my life this morning! A machine-gun burst has torn through his body just below the ribs, leaving nothing there but a spongy mass. His skin is the color of blue clay and every ounce of blood has left his body.

"Got a cigarette?" he whispers.

My hands are shaking badly as I put one in his mouth. I look around for stretcher bearers, someone to help me. I can't leave him here to die alone.

"Hey, Lieutenant, Lieutenant."

A runner staggers up.

"Captain Cass says you are to come. He's shot. Dying. They need help."

The runner sits down suddenly and groans. His body rocks back and forth. Near the shoulder is a tourniquet; his arm is broken, an artery ruptured. He is without strength to go further. He looks up dully.

"Captain Cass said for you to hurry."

I look and the remnants of the battalion are on the ground, seeking cover. A storm of high explosives and shrapnel is pounding, ripping and tearing them to shreds. A tank is stopped by a direct hit, is hit again and bursts into flames. I look at Whitey and his eyes say "goodbye." He knows the answer. I'm crying as I get up to go on.

I can't look at the rest of the fellows. I don't care whether they come or not, but they come anyhow. It's hard to walk up and into that barrage—like going into the death house. The battalion is lying down and it's hard to tell the dead from the living. It doesn't matter—none of us will live long now. I don't see Cass—he must be dead. Morris comes toward me, on his hands and knees. He is hit. He shakes his head and blood spatters. I run over and speak. He shakes blood on me and goes on, not hearing. Maybe he will never hear

again. I see Yale. He must have been separated from the company and stayed with the battalion.

"Where's the Major?" I scream.

He beckons me to follow, runs a few steps and stops, pointing rigidly. I see a shell hole, still smoking, and two bodies with Sam Brown belts. Yale remains frozen and I don't have to ask what has happened. I am now in command of the battalion.

We are a few hundred yards short of a hill crest. Somehow I know, or remember, that from that crest we can see Soissons and the railroad that feeds the Boche army to the south. We must have it and the Germans say we mustn't. Everything they have is turned on us to keep us off that hill. I run up and down, yell at Yale; we have to get them forward. Baker is helping.

"Atta boy, Baker," I yell.

We are close enough for me to see him grin. I wave "forward." A shell lands right behind him. A torn blouse leaps into the air, turns and flops soggily on the ground. Something hot and sticky wraps itself over my face. Oh God—it's a piece of his insides. I'm sick, like a dog. I can't stop spewing. I'm on the ground and struggle to get up. One of my legs won't work, but I manage to stand.

The men are all down, groveling under the pounding of shells. A machine gun opens from the hill ahead. *The Germans have gotten reinforcements there ahead of us. Well, what of it?*

It's just getting dark. The shells flash and the machine gun chatters. To hell with it. To hell with everything. Whitey gone, Baker gone, Cass and Morris—all the men—and for what? What in the whole damn world is worth all this?

"Message for the battalion commander."

A runner panting and scared to death dives into a shell hole close by. Some of the men point me out. I'm the battalion commander. I take the message.

"Move forward. The unit on your right has advanced

beyond your line and its flank is exposed. Advance at once."

Move forward, eh? I have to laugh and it hurts my leg. Funny how quick the blood dries, and the pants stick and pull at whatever kind of wound I have. It looks pretty mean. I've given away my first aid packet long past and it would take more than one of those anyhow. But to go forward?

I look at the faces I can see in the dusk. They look back at me apprehensively; they plead with their eyes for the authority I represent not to demand any more of them. They can't go on. Well, they don't have to. I'm going alone. They can't ever say I disobeyed orders. I'm going up there with Whitey and Baker and Cass. No living with only one leg, a cripple; one more hit and it's over. I'll never feel it. I'm walking, it's hard to do, but I'm going forward; me, to protect the flank of the unit that's exposed. By gosh, I'm like that lone Frenchman I saw this afternoon. I'm protecting the left flank. I wonder if he's still there. Good luck to him if he is.

That German machine gun is put-putting for all it's worth. I can't tell what it's shooting at. But it doesn't seem to be me. I'm real close too by now, and I get out my automatic. Maybe I can silence the goddamn thing before I'm finished. But somebody else is there before me. A whole bunch of men have jumped on it. They're my men—what's left of them.

They're all around and Yale or somebody is helping me into a ditch. We have the hill and we will hold it. I try to tell that to Yale, but somehow I don't seem able to talk. They make me lie down on a blanket. Pretty soon some prisoners lift me up and carry me. It's dark and I don't see so good but I suppose I'm being taken to the rear. The guns seem to have stopped. I guess the battle is over.

The French Commander speaks:

A CITATION

The General Commander-in-Chief of the French Armies of the North and Northwest cites in the Order of the Army:

"1st Lieutenant ————, ————, U.S.

In the Retz forest on July 18, 1918, though wounded in the leg, led his men for two hours through a violent bombardment; he did not leave the lines until forced to do so by loss of blood.

PETAIN."

The Historian closes the Chapter:

In creating the Marne pocket the German effort reached its highest level. The success of the Allied stroke at Soissons marked the turn in the tide; and caused the German flood to ebb swiftly from the salient. This success at Soissons was largely due to the magnificent dash and driving power of the American 1st and 2d Divisions. The end of the battle found the Germans forced back to the line of the Vesle and the Aisne rivers between Rheims and Soissons.

It was thus that American troops enabled Marshal Foch to check the Germans at a crucial moment and seize the initiative. The German sun was setting swiftly.

[Editor's Note: The company commander's diary printed here is an exact copy of a company commander's diary—with some change in names—written on the same day or within three days of the events recorded. It is a valuable historical document. The staff officer's story is taken from a personal experience monograph written some years later. It also is of historical value. All other items have been selected from official or other printed records and given—for the most part—almost exactly as written.]

CHAPTER 2

Terrain Appreciation in Defense

(INFANTRY SCHOOL TEACHING)

In maneuvers, how often have you as an infantryman been pushed forward on fairly flat ground to organize a position, while in rear is a ridge or a sweetly rolling line of hills? How often have you longed for these heights and muttered at the ineptitude—perhaps you used a stronger word—of the division or other staff which placed the infantry line ahead of this beautiful high ground? Perhaps someone has told you that the artillery needed this high ground for observation, and you have damned them for a set of scenery-gazing wagon soldiers who push the infantry off the best fighting ground so that they—the artillery—could enjoy a clear view of the fight. Perhaps, on the other hand, you have said nothing; but someone does, for keep your ears open and you can hear the rumble of the talk.

And perhaps the grumblers are right. Maybe the infantry could fight a better battle if they occupied these choice slopes. That is, if the infantry were fighting without artillery against an enemy also without artillery.

But such things do not often happen in modern war, for infantry and artillery are the Siamese twins of battle and go together as naturally as ham and eggs. This being so, forget how well your infantry could organize centers of resistance and what not, on the heights to the rear and give them to the artillery to see from. Give them up or take the consequences. This will be tough. The enemy artillery will blow you clean out of your neat trench sys-

tem on the heights; while your artillery, unable to see, strives frantically to hit something—anything this side of the moon. And after the enemy pulverizes you at his leisure, he will send over his infantry to dust you off the high ground—what's left of you.

The first lesson in terrain appreciation, then, is that the artillery gets the high ground for observation and that the infantry protects this observation. And do not bear down too hard on that "infantry protecting the artillery." For the artillery furnishes some high class protection for the infantry, it should be observed. Who is protecting who, when the artillery lobs over shells to break up a dangerous attack, or to chase away a battery that by knocking out your machine guns is playing "hell and all" with your beautiful interlocking bands of machine-gun fire, and thus letting enemy infantry seep into the position? And who reaches well back into the rear areas and puts communications out, or hammers enemy reserves in position, or combs defiladed areas, or plugs gaps in the fires in front of the position? Not the man with the bayonet—not just yet. It is the artillery furnishing protection to the infantry.

But to do all these things the artillery must have observation. Therefore the infantry sites its defensive line so that the artillery has this observation.

As a consequence, the infantryman can never expect perfect ground or even the best ground to organize. His job is to take the ground as it is and so utilize it that he obtains the best results. This means, essentially, that all defensive factors must lock in with the terrian. Thus terrain cannot be considered apart from the men and the weapons to be used on it. There is no such thing as "pure terrain appreciation" for the soldier. We leave that for the landscape artist.

The infantryman's job is to take a line of defense laid down for him and then fit his men and fires to the terrain so that he secures the maximum blocking effect to an enemy advance. But to do this thing the infantryman must

know his terrain just as well as he knows his weapons.

Before proceeding with an analysis of the function of terrain in a defensive organization, it will be necessary to give a short resume of the nature of the defensive fires which must be fitted to the terrain by the infantry commander.

In doing this, the first thing to remember is that the defense must seek to gain and maintain fire superiority. To do this it usually has to make up for its numerical inferiority in weapons by better coordinated, better directed, and better controlled fires. This is usually possible because the defender has better observation, better cover, better concealment, and greater opportunity for coordination and control than the attacker. Plans for defensive fires must provide for placing fire, when the enemy attacks, well to the front of the position in an effort to break up, or disorganize, his attack before it gets well started. These plans must also provide for fires that increase in intensity and effectiveness as the hostile attack approaches the battle position and for fires within the battle position itself as well. To accomplish these three things the various weapons of the defense are employed in combination. The tasks are determined and each task is given to the weapon best fitted for it. The artillery fires on the hostile approach as it forms for attack, covers the main line of resistance, and brings fire to bear on hostile elements that succeed in penetrating the battle position. Infantry mortars are used in much the same manner within the limitations of their range. Light machine guns and riflemen in the forward combat groups open fire on the attacking troops as soon as they come within range. The forward combat groups are so located that as the attack approaches close to the main line of resistance the light machine guns near that line cover the front of the position as completely as they can with enfilading and mutually supporting fires. Light machine guns in rear combat groups fire in support of forward combat groups and also support adjacent combat groups with close-in flanking fires. Heavy machine guns

(caliber 0.30) are disposed in width and depth throughout the defensive area to cover the most dangerous areas of enemy approach to the most vital terrain features within the position, and to protect with close-in flanking fires the combat groups guarding these vital terrain features. They are usually located in combat groups for protection. Machine guns then are the framework of the defense and are the basic holding element. Riflemen provide protection for the machine guns, supplement their fire where necessary or cover with their fire areas which cannot be covered by the machine guns. Riflemen are also the counterattacking element of the defense. Heavy machine guns in the rear part of a defensive area may be employed for long range indirect, interdiction, and harassing fires. The caliber 0.50 machine guns are sited in width and depth throughout the defensive area to cover probable avenues of tank approach both in front of and within the battle position. Tanks of the defense are used in counterattack. Chemical weapons can be employed to supplement artillery and infantry fires.

With this defensive fire picture firmly fixed in mind the next step is to apply these general principles to a specific situation—or, in other words, adjust them to the terrain. It is at this point that the commander encounters difficulties. To apply a general principle successfully is always difficult; but here the application is rendered doubly hard by the necessity of applying it to terrain which in itself must be analyzed, weighed, and valued. Hence the great importance to the infantryman of a method of evaluating terrain so that he may quickly and easily adapt his means to it.

The purpose of this chapter, therefore, is to consider how the infantryman can utilize normal terrain and indicate a method of analyzing this terrain which will make the problem of defensive organization less difficult. Since terrain, as has been indicated, is but one factor—though the basic one—in the commander's defense problem, it will be necessary to show how all the other factors lock

in with the terrain. Thus it is best to start with the issuance of the defense order.

After receiving orders for defense, a sector commander must develop his plan of defense. This plan of defense of a sector includes the designation of tactical localities to be organized, a plan of fires, and plans for counter-attacks. This will involve a consideration of many factors, such as the size of the sector, the mission, and the strength of the units, and also—something often slurred—a minute consideration of terrain within and adjacent to the sector. This careful analysis of the terrain, based on a map study and a reconnaissance of the ground, is absolutely necessary before a commander can determine the terrain factor in his defensive problem and how he shall take it into account.

It is terrain that dictates the fire pattern of the defense. The complete foreground of, and the area within, a battle position must be covered by defensive fires; but the volume of fire and the types of fire placed in different areas will vary in accordance with the terrain. For example, open areas, affording little or no cover or defilade, can be denied to the enemy by a relatively small volume of fire, usually from weapons of flat trajectory. On the contrary areas that afford cover and defilade to the enemy will require a larger volume of fire to block effectively the enemy's approach. Moreover, in the usual case such areas can be blocked only with the aid of artillery and infantry mortar fires. It follows then, that defensive fires improperly distributed are wasted, and the defense thus weakened.

In short, fires—no matter how heavy—not adjusted to fit the terrain do not aid the defense but rather weaken it. Thus the conclusion is inescapable that in defense the terrain and the available fire power should be considered together and blended to make an efficient defensive plan.

To permit this blending of fire and terrain the sector commander should analyze the ridge lines and woods, and the character of the terrain compartments in and ad-

jacent to his sector. He should then consider how these terrain compartments (which vary in each situation as to number, size, and form) will influence his plan of defense.

A corridor of terrain of suitable form and size, favorably located with respect to the defensive position, constitutes a most advantageous approach for an attacking force, whether it be a rifle platoon, company, or battalion. (See Figure 4, which pictures such a corridor.) By all means, then, corridors or avenues of approach leading up to and into the defensive position should be well blocked by defensive fires. In some situations an analysis of terrain will determine that there are a number of such corridors in a sector and that the defense cannot distribute fires to block effectively enemy approach through all of them. This may be because the defender lacks supporting fires of the type best suited to the mission, in sufficient amount, or that rifle and light machine-gun fires (when such fires are suitable for the purpose) cannot be concentrated in all corridors to the extent desired without causing too great a reduction of fires in areas of lesser importance.

When confronted with a situation of this kind, a sector commander should insure that available fires are distributed so that the greatest proportion *is placed in corridors through which the enemy is most likely to advance in greatest strength*, even though this causes a reduction of fires below that desirable in the other corridors. * This is in keeping with the general principle that the greatest fire effect is secured when fires are distributed in a manner which will tend to prevent large numbers of the enemy from getting close to the position.

To know or to estimate accurately which corridor, or corridors, the enemy will use to penetrate the position, the sector commander must be capable of analyzing the terrain and deciding how this terrain will assist the enemy

* See Chapter I, Volume IX, Mailing List, for a discussion and analysis of terrain compartments and terrain corridors.

and hinder the defense. This is basic. Therefore, a priority of importance of corridors must be established. When there is only one corridor, leading to the defensive position, of such width as to permit the advance of a unit large enough to make a strong attack against the position, this alone establishes this corridor as of first priority.

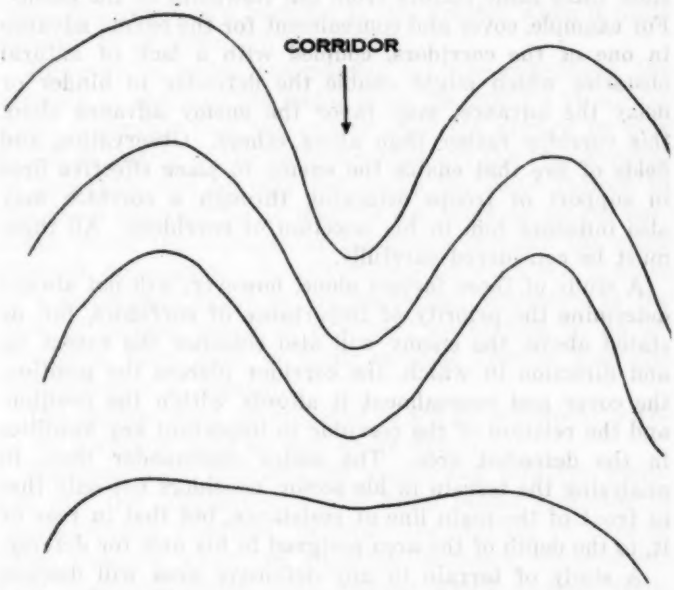

FIGURE 4.—A terrain corridor leading into a position.

Often, however, a number of corridors of approximately equal width are available for enemy approach. Normal frontages in attack will seldom permit the enemy to utilize all of these corridors to the maximum. The enemy, we may be sure, will, in such cases, approach our position in greatest strength through those corridors which offer him the best advantages. He will select his corridor for advance after a comparison of the available corridors as to

the following: cover and concealment, obstacles, observation and fields of fire for supporting weapons, extent and direction of the corridor and its location with respect to important key localities which the enemy desires to capture.

Therefore, in determining the priority of importance of several wide corridors, a sector commander should consider these same factors from the viewpoint of the enemy. For example, cover and concealment for the enemy advance in one of the corridors, coupled with a lack of natural obstacles which might enable the defender to hinder or delay the advance, may favor the enemy advance along this corridor rather than along others. Observation and fields of fire that enable the enemy to place effective fires in support of troops attacking through a corridor may also influence him in his selection of corridors. All these must be considered carefully.

A study of these factors alone, however, will not always determine the priority of importance of corridors, for, as stated above, the enemy will also consider the extent to, and direction in which, the corridor pierces the position, the cover and concealment it affords within the position, and the relation of the corridor to important key localities in the defended area. The sector commander then, in analyzing the terrain in his sector, considers not only that in front of the main line of resistance, but that in rear of it, to the depth of the area assigned to his unit for defense.

A study of terrain in any defensive area will disclose certain localities of primary importance. These localities for the smaller units, to include the regiment, are usually elevations within the battle position, which afford commanding observation. For units larger than the regiment they may be elevations, roads, railroads, bridges, villages or woods, located in rear of the battle position. All such areas are referred to as "keypoints." Their possession may not only be vital to the defense but to the attack as well. The sector commander should first of all determine the keypoints in his sector and then the relation of the terrain corridors in his sector to these keypoints. To this

he should add a consideration of the fields of fire, cover, concealment, and observation in the area in rear of his main line of resistance.

In general, corridors which permit the enemy to approach in strength and under cover up to, and well into, the position will often determine the area of strongest attack. The probability that the strongest attack will be made through such a corridor is still greater when it leads directly to or toward a keypoint.

However, a sector commander in thus examining the terrrain in and near his sector from the enemy's viewpoint must remember that the enemy may not always be able to tell as clearly as the defender what are the best avenues of approach, and he may not weigh the same factors in the same manner; or he may, in an effort to secure surprise, throw the strength of his attack through the more difficult approaches. A unit entrusted with the defense of a sector can, under no circumstances, withdraw in the face of atttack unless it has been authorized to do so. Provision, then, must be made to shift fires to meet the developments of combat.

The defense must be prepared to act by movement within its defensive area as well as by fire.

Supplementary positions for supporting infantry weapons and the selection of routes from initial positions to supplementary positions, facilitate the shifting of fires of these weapons when the situation demands. Supplementary positions within each combat group permit flexibility in fire distribution within the area defended by the combat group. Time permitting, supplementary combat groups may be prepared, especially in the rear part of the position, for occupation when necessary.

It is not usual during the defensive battle to reinforce any of the forward combat groups with rifle units from rear combat groups or to move rifle units from one forward combat group to another forward combat group, because the reinforcement of forward combat groups with units in rear sacrifices depth to the defense.

Situations sometimes arise, however, during combat

which call for the readjustment of troops on the battle position. For example, developments in the defensive battle may clearly indicate that the enemy attack in one part of a sector has been definitely stopped, while an unexpected and dangerous threat has developed in another part of the sector calling for greater strength in the threatened area. The sector commander, when confronted with a situation of this kind, might well move some of the rifle units occupying combat groups against which no further threat is expected to develop, to reinforce combat groups that are dangerously threatened. Such movements should be made under available cover.

In short, the selection of supplementary positions for supporting infantry weapons, provision for all-around defense combat groups, plans for counterattack and, under some conditions of mission and terrain, plans for the shifting of rifle units provide that mobile and rigid defense can be so combined during the defensive battle as to assure the retention of keypoints essential to the defense.

Rifle units can best be disposed to block enemy advance in a corridor by occupying the high ground usually found on the shoulders of the corridor. This will usually enable them to place flanking fires across the corridor. Observation and good fields of fire into the corridor from higher ground in rear is desirable. (See Figure 5.) Dead spaces in the sector of light machine-gun fires are covered by rifles.

Figure 6 illustrates the sector of an interior regiment in defense. Three corridors numbered from right to left lead into the position. Each corridor is of such a size as to permit a rifle company to advance and attack along it. The hill at A is the keypoint of the regimental area. It permits observation over a large part of the sector. High ground at B permits the enemy to observe effectively and support attacking units advancing through any one of the three corridors.

Corridor 1 offers a covered avenue of approach up to and into the position; but the corridor leads to open ground within the position which can be well covered by defensive

fires. An enemy attack through this corridor may succeed in penetrating the position, but once attacking units reach the open ground at the end of the corridor they will find further advance difficult. Corridor 2 is a covered avenue extending the entire depth of the battle position and lead-

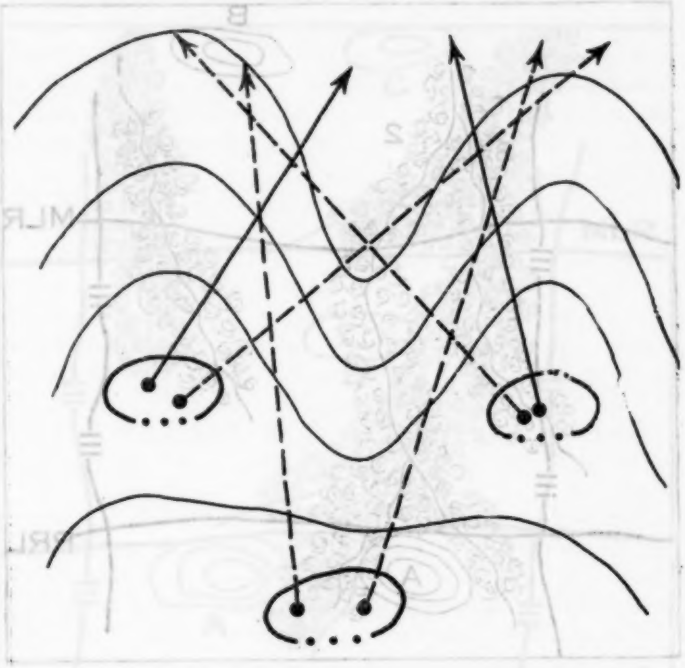

FIGURE 5.—Defense of a corridor.

ing direct to the keypoint A. An attack through this corridor will find cover from defensive fires and might reach positions from which to threaten the keypoint A. Corridor 3 also provides a covered avenue of approach into the position and leads to positions close to A. A strong attack through this corridor in conjunction with a strong attack through corridor 2 would be a serious threat against the

keypoint of the area. It is probable then that the enemy will make his strongest attack against the left part of the area in an effort to capture A. The priority of importance of corridors is therefore: 2, 3, 1.

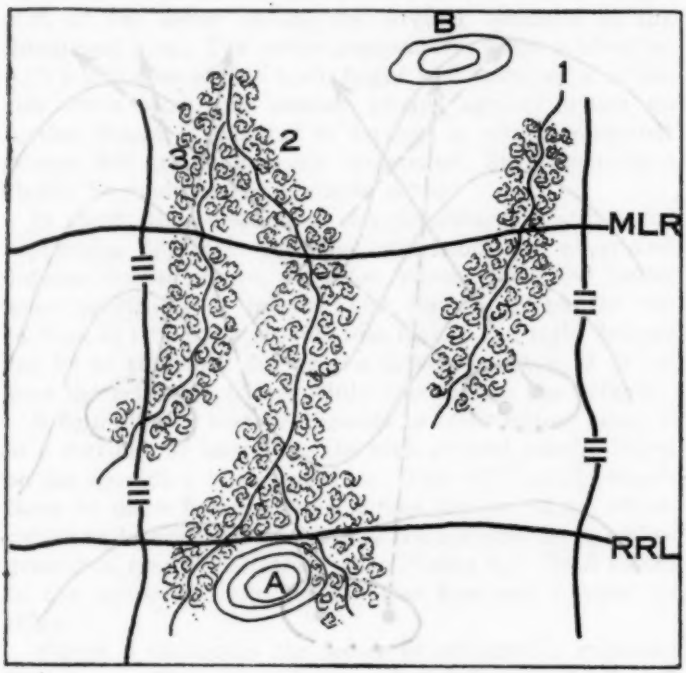

FIGURE 6.—Sector of an interior regiment in defense.

Figure 7 illustrates two corridors leading into a regimental area. The keypoint of the area is the hill at A. Another hill B is a keypoint in the sector of a lower unit of the regiment. High ground at C permits observation of B but not A. A can be partially observed from B. Both corridors are of such size as to permit an attack along them by two rifle companies.

Corridor 1 offers a covered avenue of approach extending throughout the entire depth of the battle position, and leads to both B and A. Corridor 2 is a covered avenue into the position in the direction of A. An attack through this

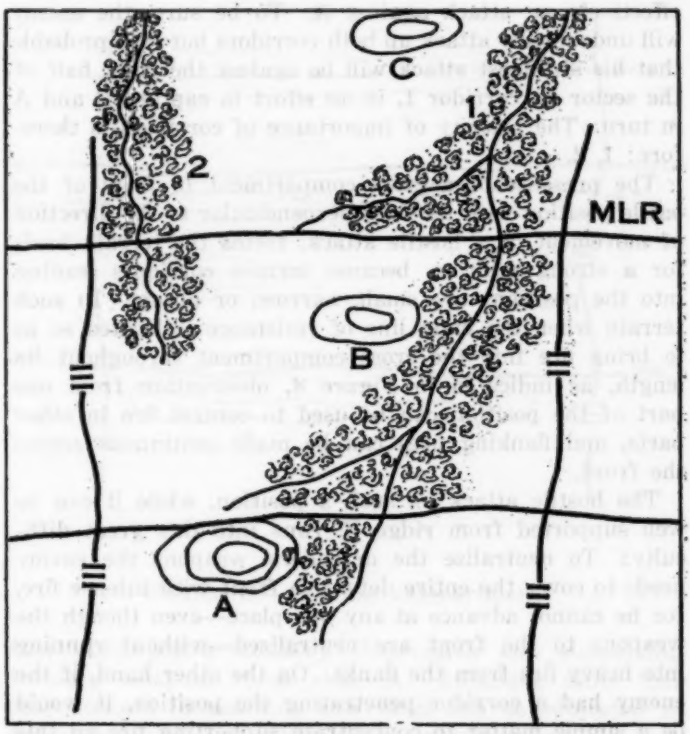

FIGURE 7.—Two corridors leading into a position.

corridor, however, must advance over open ground within the position before reaching A. It would be subjected to heavy fires as it crossed this open ground. An attack through corridor 1 on the other hand can approach both B and A under cover. Observation from C will enable the

enemy to support effectively an attack through this corridor against B with artillery and other supporting weapons. If the enemy succeeds in capturing B he has gained the advantage of some observation on A. This observation will disclose to the enemy the defensive dispositions for the defense of A and will also permit him to support effectively an attack against A. To be sure, the enemy will undoubtedly attack up both corridors but it is probable that his strongest attack will be against the right half of the sector up corridor 1, in an effort to capture B and A in turn. The priority of importance of corridors is therefore: 1, 2.

The presence of a cross compartment in front of the battle position with its sides perpendicular to the direction of movement of a hostile attack, forms the terrain basis for a strong position, because terrain corridors leading into the positions are small, narrow, or absent. In such terrain when the main line of resistance is located so as to bring fire into the cross compartment throughout its length, as indicated in Figure 8, observation from one part of the position can be used to control fire in other parts, and flanking fires can be made continuous across the front.

The hostile attack on such a position, while it can be well supported from ridge B, runs into this great difficulty: To neutralize the defenders' weapons the enemy needs to cover the entire defensive front with intense fire, for he cannot advance at any one place—even though the weapons to the front are neutralized—without running into heavy fire from the flanks. On the other hand, if the enemy had a corridor penetrating the position, it would be a simple matter to concentrate supporting fire on this corridor, neutralize the defensive weapons there, and the infantry could then move forward without coming under heavy flanking fire. Thus the enemy could shoulder his way into the position. As can be seen such a scheme is not possible with the terrain pictured in Figure 8.

In addition to all this, the attacker's observation and fields of fire into the battle position are also limited by the

high ground on which the main line of resistance is located. Hostile supporting fires directed against tactical localities on the main line of resistance will be masked when his attacking units arrive close to this line, and must then be lifted. They cannot be placed effectively within the posi-

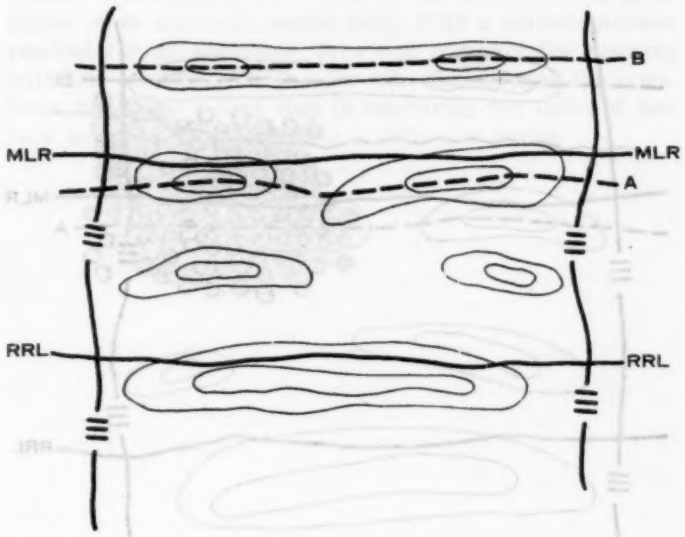

FIGURE 8.—A cross compartment.

tion until hostile artillery observation and supporting infantry weapons reach ridge A. Attacking units that may succeed in reaching this ridge can be subjected to heavy fire from tactical localities in rear which have not suffered losses from the observed fire of hostile supporting weapons. The defense is thus favored on this type of terrain, and units usually occupy wider frontages.

However, it is not usual to find a cross compartment of this type extending across the entire front of a regimental sector. Usually, a cross compartment is made narrow in

places by woods and small corridors that branch off from the cross compartment. Figure 9 shows a cross compartment containing a small stream. A tributary of this stream forms a small corridor penetrating the position on the right of the sector. Furthermore, the woods on the

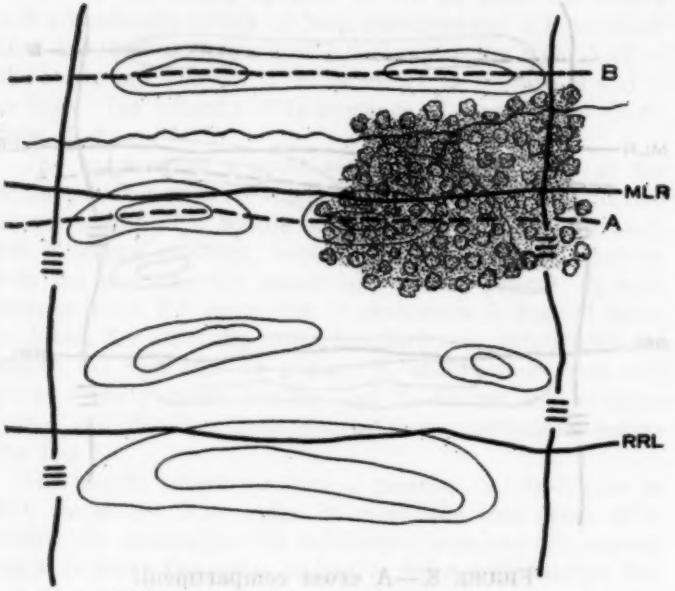

FIGURE 9.—A cross compartment with corridor entering the position.

right narrow the cross compartment in that locality. Fields of fire on the right are therefore limited, and flanking fires cannot be placed across the entire front of the position. The right part of the position is thus weakened and greater defensive strength would be required here than on the left.

In order to afford practice in analyzing terrain in accordance with the methods outlined, four simple problems are offered. The answer to the questions may be obtained by a careful study of the terrain pictured in each problem. The reader will get the best results by carefully studying each map and arriving at a decision on each point separately. If necessary, turn back to the discussion of principles, when any point seems hazy. With a definite answer reached for all questions, turn and compare the answers with the solution. The reader who can answer the questions has taken a long step in mastering the value of terrain and how to utilize it in a defensive battle.

ILLUSTRATIVE PROBLEMS

Problem Number 1

Figure No. 10 represents a defensive sector to be occupied by a regiment. Sector boundaries, the general trace of the main line of resistance and the general trace of the regimental reserve line are shown in the sketch.

Analyze the terrain, within and adjacent to the sector, and come to a decision on the following:

1. What are the keypoints in the sector?

2. Where, in all probability, will the strongest enemy attacks against the position be made?

3. What part of the defensive position is weakest?

4. What disposition should be made of the rifle units for defense of the assigned area?

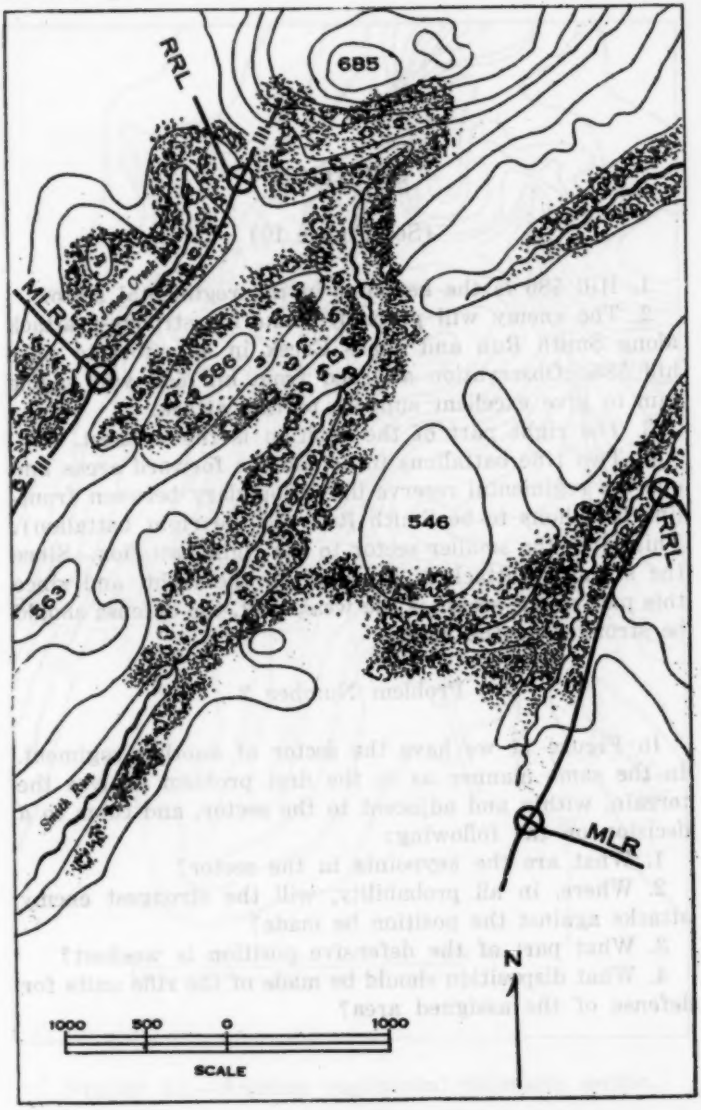

FIGURE 10.—Regimental defensive sector.

SOLUTION

(See Figure 10)

1. Hill 586 is the keypoint in the regimental sector.
2. The enemy will probably make his strongest attack along Smith Run and Jones Creek in an effort to seize hill 586. Observation afforded from hill 563 will enable him to give excellent support to this attack.
3. The right part of the position is the weakest.
4. Two rifle battalions to defend the forward areas and one the regimental reserve line. Boundary between front-line battalions to be Smith Run (to the right battalion). This gives the smaller sector to the right battalion. Since the strongest attack is expected on the right, and since this part of the sector is the weak part, the defense should be stronger on the right.

Problem Number 2

In Figure 11 we have the sector of another regiment. In the same manner as in the first problem analyze the terrain, within and adjacent to the sector, and come to a decision on the following:

1. What are the keypoints in the sector?
2. Where, in all probability, will the strongest enemy attacks against the position be made?
3. What part of the defensive position is weakest?
4. What disposition should be made of the rifle units for defense of the assigned area?

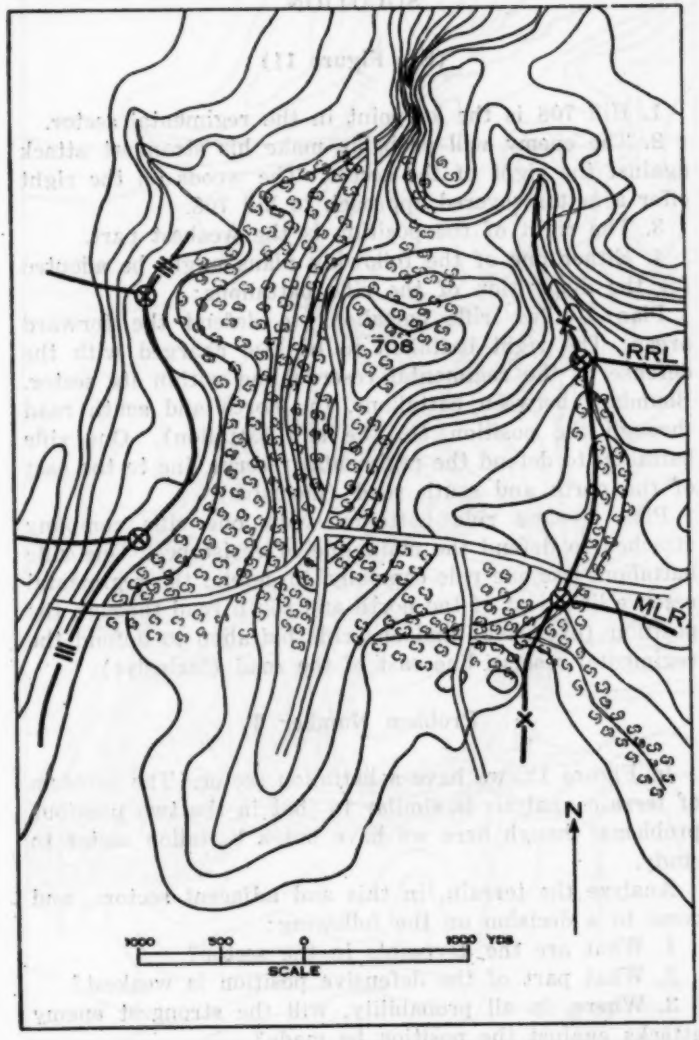

FIGURE 11.—Another regimental defensive sector.

SOLUTION

(See Figure 11)

1. Hill 708 is the keypoint in the regimental sector.
2. The enemy will probably make his strongest attack against the right of the sector. The woods on the right offer a better covered approach to hill 708.
3. The right of the position is the weakest part.
4. Either one of the following plans might be adopted for the disposition of the rifle battalions:

Plan 1—Two rifle battalions to defend the forward areas. The right battalion to be also charged with the defense of the regimental reserve line within its sector. Boundary between battalions, the north and south road through the position (to the left battalion). One rifle battalion to defend the regimental reserve line to the east of the north and south road (inclusive).

Plan 2—One rifle battalion with one rifle company attached to defend the main line of resistance. One rifle battalion, less one rifle company, to defend the regimental reserve line west of the north and south road through the position (exclusive) and one rifle battalion to defend the regimental reserve line east of the road (inclusive).

Problem Number 3

In Figure 12, we have a battalion sector. The problem of terrain analysis is similar to that in the two previous problems, though here we have but a battalion sector to study.

Analyze the terrain, in this and adjacent sectors, and come to a decision on the following:

1. What are the keypoints in the sector?
2. What part of the defensive position is weakest?
3. Where, in all probability, will the strongest enemy attacks against the position be made?
4. What disposition should be made of the rifle units for defense of the assigned area?

FIGURE 12.—A battalion defensive sector.

SOLUTION

(See Figure 12)

1. Hills at C and D.
2. The right part of the position is the weakest because of the covered approaches leading to A.
3. The enemy will probably approach the position in greatest strength along the wooded corridor east of A, in an effort to capture initially the hill at A. Once this hill has been captured the attack will be directed through the woods against B. The capture of B will enable the enemy to support an attack against C.
4. The rifle companies to be disposed as follows:
   One company in defense of A.
   One company in defense of B.
   One company as battalion reserve in defense of C and D.

Boundary between front-line companies: the draw east of A giving the draw to the right company. This gives to the left company the small stream east of A and all of hill B.

Problem Number 4

Figure 13 is another battalion sector. Analyze the terrain, within and adjacent to the sector, and come to a decision on the following:

1. What are the keypoints in the sector?
2. What part of the defensive position is weakest?
3. Where, in all probability, will the strongest enemy attack against the position be made?
4. What disposition should be made of the rifle units for defense of the assigned area?

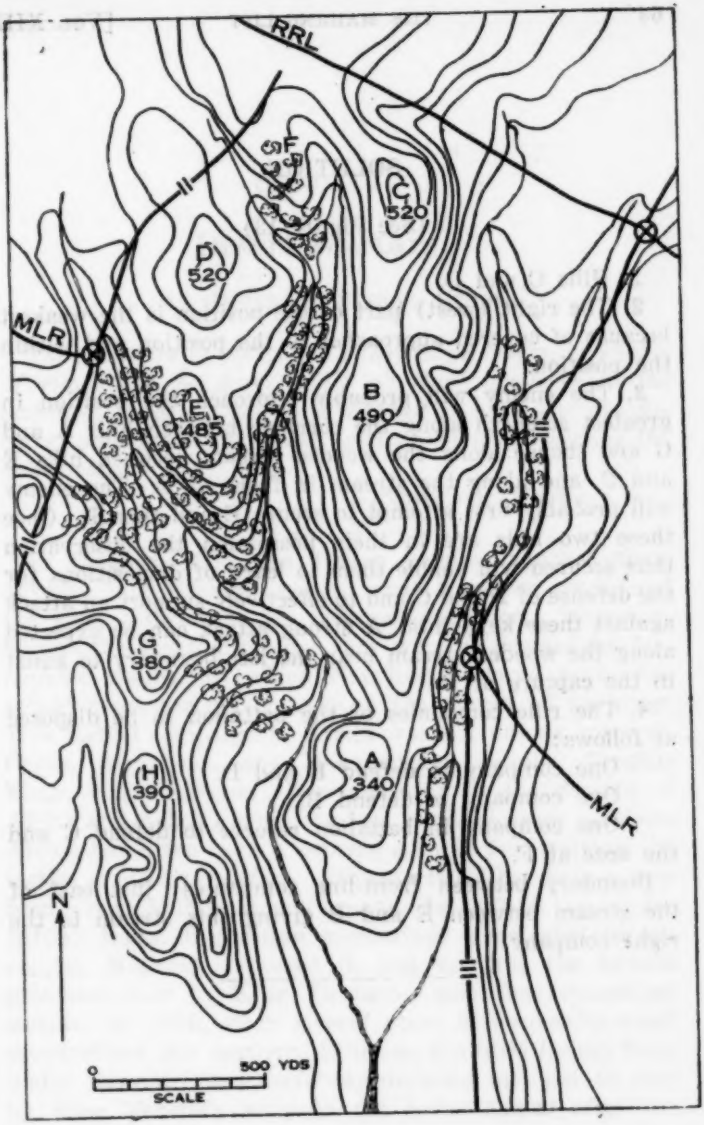

FIGURE 13.—Another battalion defensive sector.

SOLUTION

(See Figure 13)

1. Hills C and D.

2. The right (west) part of the position is the weakest because of covered approaches to the position and within the position.

3. The enemy will probably approach the position in greatest strength along the corridor between hills A and G and thence along the wooded stream between hills E and B, and along the stream in front of E. The enemy will probably first attempt to secure E and then B. Once these two hills are in their possession the observation thus secured will enable them to learn of dispositions for the defense of D and C and to effectively support an attack against these keypoints. A strong attack can be expected along the wooded stream near the left boundary to assist in the capture of B.

4. The rifle companies of the battalion to be disposed as follows:

One company to defend E and D.

One company to defend B.

One company in battalion reserve to defend C and the nose at F.

Boundary between front-line companies: just east of the stream between E and B giving this stream to the right company.

CHAPTER 3

Desert Warfare

(AN INFANTRY SCHOOL STUDY)

The frontiers of states are either large rivers, or chains of mountains, or deserts. Of all these obstacles to the march of an army, the most difficult to overcome are deserts; mountains come next; and broad rivers occupy the third place.

—Napoleon: Maxim I.

In October, 1935, the Italian armies launched their advance into Ethiopia across what Napoleon considered the most difficult of all frontiers—a desert. Moreover, beyond the frontier regions they were confronted by formidable mountains, which Napoleon declared to be the second most serious obstacle to the march of an army. This Italian campaign in Africa was not unique however. Cyrus, Alexander, and Mohammedan caliphs, Genghis Khan, and Napoleon, all waged war in the deserts of Africa and Asia. During the past hundred years northern Africa has often been a proving ground for evolving the tactics of desert warfare. Ethiopia itself has before now been a part of this proving ground. In 1867-68 the Napier British Relief Expedition successfully penetrated to the capital, Magdala, captured it, and set free the British prisoners held by King Theodore, who then committed suicide. In 1896, after several years of successful small penetrations into northern Ethiopia, the little Italian force under Baratieri was decisively defeated and put to rout by King Menelik's army in the battle named after the near-by town of Adowa.

The recent Italian operations were especially interesting, not only because of the problems imposed by desert and mountain, but more especially because of the modern, motorized, mechanized, and air-minded army that engaged the courageous but poorly trained and equipped native tribesmen. Though this campaign is classed as a "small war" in military parlance, over 300,000 soldiers and tens of thousands of laborers were in Eritrea, Somalia, and Ethiopia by the end of 1935. (See Figure 14.)

In the pages that follow the special aspects of deserts will be considered and it will be shown how these have influenced the conduct of former desert campaigns and also the one recently ended. To officers of our own army special operations have always been vitally important, and desert campaigns especially so, inasmuch as we too have extensive arid, barren tracts in the West and Southwest. (See Figure 15.) Our deserts have been the setting for military operations in the past and may conceivably be again.

In this chapter the subject can be given only a sketchy discussion. For the benefit of any readers desiring to study desert operations further, the bibliography used in preparing this material is given at the end of the chapter.

EFFECT OF DESERT CONDITIONS ON MILITARY OPERATIONS

What is a desert? "A desert is a barren tract incapable of sustaining any considerable population without an artificial water supply, and almost destitute of moisture and vegetation."* The surface of a desert country varies considerably. It may be flat, rolling, or mountainous. It may consist of barren tracts of stony plains, of undulating areas of sand and scrub, of sand dunes up to several hundred feet in height, or of hills and mountains of naked rock scarred by the beds of dry torrents. In mountainous sections of desert country, military operations combine

* Webster's New International Dictionary.

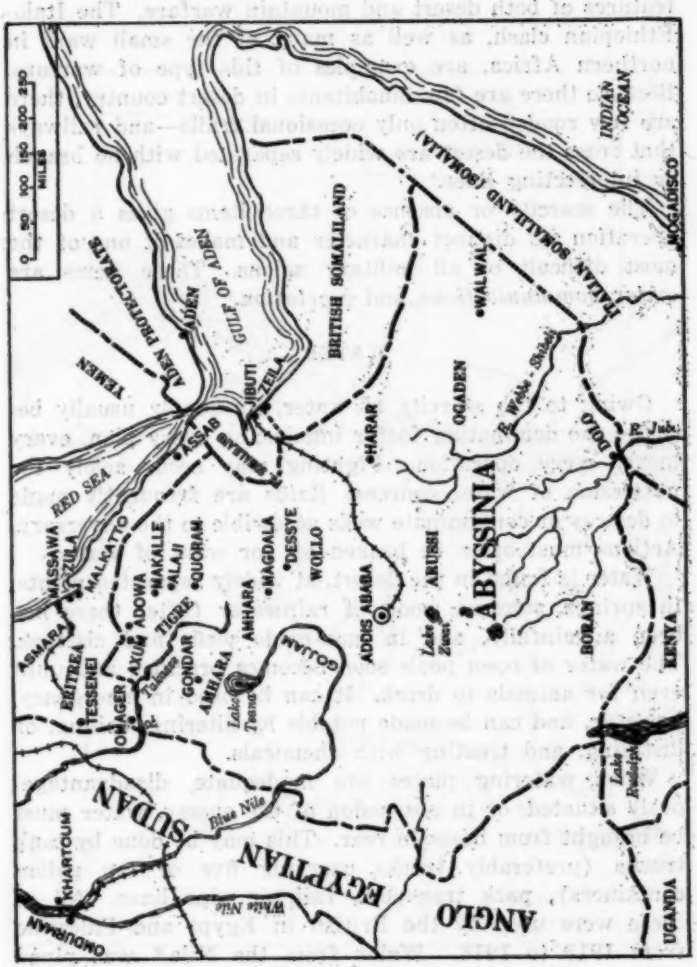

FIGURE 14.—Abyssinia (Ethiopia).

features of both desert and mountain warfare. The Italo-Ethiopian clash, as well as many of the small wars in northern Africa, are examples of this type of warfare. Because there are few inhabitants in desert country, there are few roads—often only occasional trails—and railways that cross the desert are widely separated with no branch or intersecting lines.

The scarcity or absence of three items gives a desert operation its distinct character and makes it one of the most difficult of all military acions. These items are *water, communications,* and *vegetation.*

WATER

Owing to the scarcity of water, its supply usually becomes the dominating factor influencing every plan, every move, every operation. Fighting may occur solely for possession of water sources. Raids are frequently made to destroy or contaminate wells accessible to the adversary. Actions must often be broken off for want of water.

Water is found in the desert, at widely separated points, in springs, streams, pools of rainwater (after there has been a rainfall), and in man-made wells and cisterns. The water of open pools soon becomes brackish and unfit even for animals to drink. It can be used in emergency, however, and can be made potable by filtering, boiling, or distilling, and treating with chemicals.

When watering places are inadequate, disadvantageously situated, or in possession of the enemy, water must be brought from bases in rear. This may be done by tank trucks (preferably trucks carrying five or ten gallon containers), pack transport, rail, or pipe lines. All of these were used by the British in Egypt and Palestine from 1915 to 1918. Water from the Nile * was piped under the Suez Canal, across the Sinai Desert, and into Palestine, a distance of 140 miles, thereby, it is said,

* The pipe line actually led from the Sweet Water Canal, which was an offshoot of the Nile River.

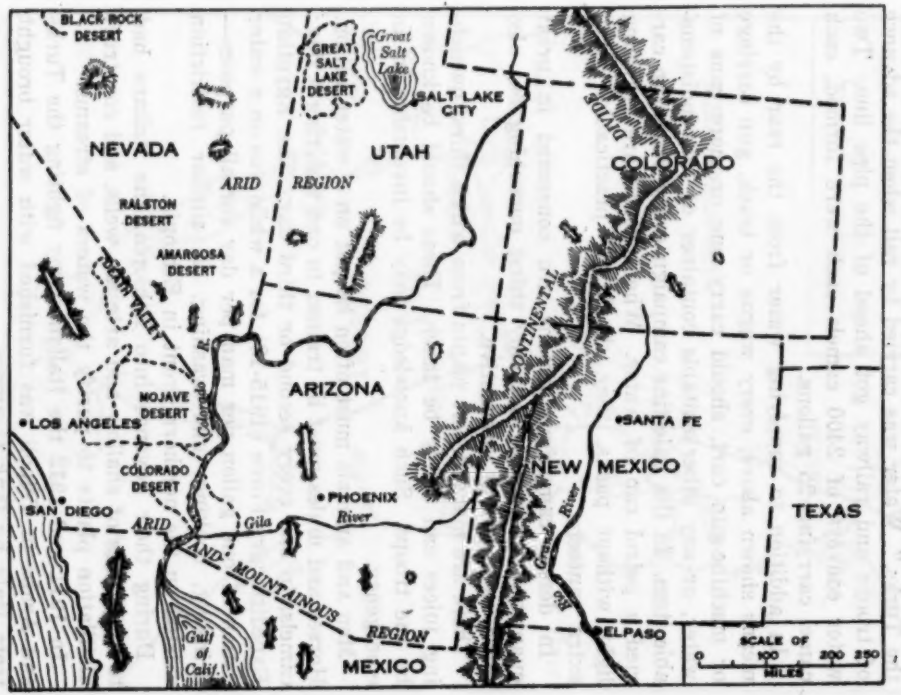

FIGURE 15.—Southwestern states.

fulfilling an ancient prophecy, "When the waters of the Nile came to Palestine, Jerusalem would be retaken from the Turks." Water was carried by rail when the advance of troops and railway got ahead of the pipe line. Two water convoys of 2400 camels each were formed, each camel carrying 25 gallons.

In addition to supplying water from the rear by the means shown above, every wagon or truck, gun carriage or machine-gun cart, should carry one or more cans of water, or any other suitable container of this indispensable item. In the Palestine campaign every Ford van carried a petrol can of water. When troops are traveling light without packs, they should, if practicable, carry extra canteens.

In desert campaigns lemons are consumed in great quantity, as they are not only thirst quenching but also serve as a scurvy preventive.

There are many desert plants from which thirst-quenching juices can safely be taken. These should be known by the troops. Such knowledge may be invaluable in an emergency.

Men and animals must often be put on a water ration. Horses and mules must be trained to one watering a day; camels, to one every second or third day. The Egyptian Expeditionary Force (1915-18) for a while was on a water ration of one gallon per man per day for all purposes—drinking, cooking, and washing. A similar restriction existed on the northern front in Ethiopia.

During their advance into Ethiopia, the Italians had to dig scores of shallow and artesian wells, and construct distillation plants to purify the waters of streams.

In 1911 and 1912 the Italian Army fighting the Turks and Arabs in Tripoli was furnished with water brought from Italy by tank steamers.

Isolated detachments may have to be supplied with both food and water by air. In the French Moroccan campaigns an isolated post had to be supplied with water by dropping cakes of ice from an airplane, owing to the impossibility of landing the plane. In the Italian operations in the

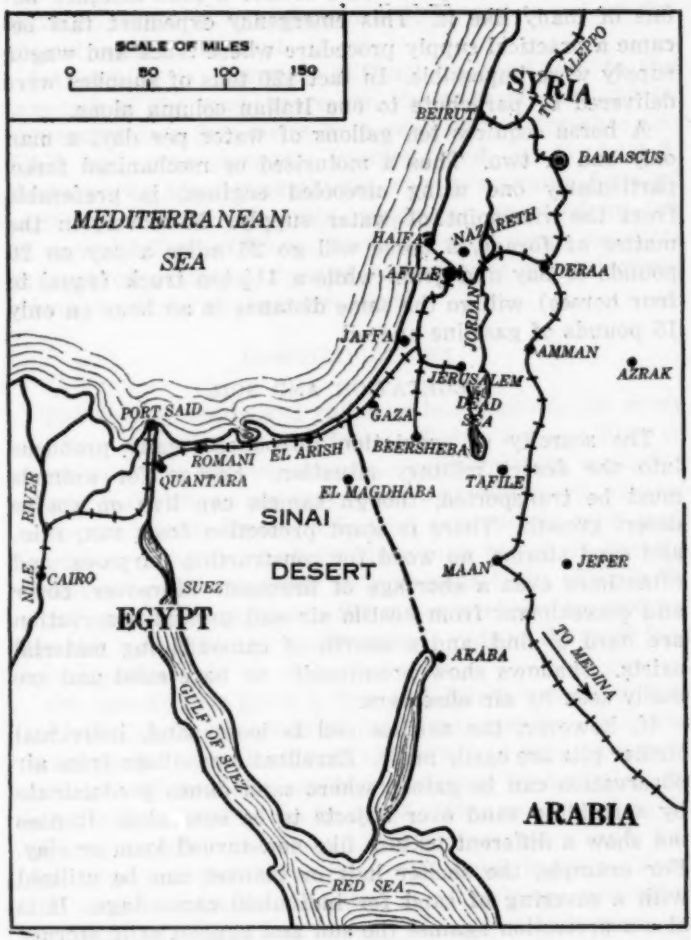

FIGURE 16.—Sinai Desert (Egypt) and Palestine.

vicinity of Amba Alaji, a force received both food and water by air transport. This is not a lone instance but one of many like it. This emergency expedient fast became a practical supply procedure where truck and wagon supply were impossible. In fact 120 tons of supplies were delivered by parachute to one Italian column alone.

A horse requires ten gallons of water per day, a man only one or two. Thus a motorized or mechanized force, particularly one using aircooled engines, is preferable from the viewpoint of water supply. Moreover, in the matter of forage, a horse will go 25 miles a day on 20 pounds of hay and grain while a 1½-ton truck (equal to four horses) will go the same distance in an hour on only 15 pounds of gasoline and oil.

VEGETATION AND SOIL

The scarcity of vegetation introduces many problems into the desert military situation. Forage for animals must be transported, though camels can live on coarse desert growth. There is scant protection from sun, rain, and sand storms, no wood for construction purposes, and oftentimes even a shortage of firewood. Moreover, cover and concealment from hostile air and ground observation are hard to find, and a dearth of camouflaging material exists. Shadows show prominently on bare sand and are easily seen by air observers.

If, however, the surface soil is loose sand, individual shelter pits are easily made. Excellent camouflage from air observation can be gained where sand dunes predominate by sprinkling sand over objects to be concealed. It does not show a different texture like new-turned loam or clay. For example, the shelter half or blanket can be utilized with a covering of sand for individual camouflage. It is also a protection against the sun and against sand storms. A pit in the sand protects from the heat in summer and the cold in winter.

Sand or dust storms frequently occur in the desert with devastating effects on everything in their path. Therefore,

precautions must be taken to protect food, forage, equipment, and weapons. Again the shelter half or blanket is useful to screen guns and other objects, and to put on the ground under equipment.

Intrenching is extremely difficult in sand due to the looseness of the sand; moreover, the work of days can be obliterated in a few hours by a sand storm; trenches are filled up, entanglements covered, and roads buried. Breastworks are frequently the only practicable form of artificial cover. Knife rests, which can be lifted up out of accumulations of blown sand, are much more practical than apron or fence types of barbed wire entanglements where sand storms are prevalent.

COMMUNICATIONS

The lack of roads and railways has handicapped every military operation in the desert. Today railway lines of communication are less essential, but a military operation of any mangnitude requires roads that will carry wheeled transport. Small forces, it is true, can operate with pack transport away from roads. But pack transport has the disadvantage of requiring an enormous train of animals, which, in turn, aggravates the water problem (except for camels). And forage requirements reduce the pay load to insignificance.

On terrain that gives a firm and fairly smooth surface for vehicles, the absence of roads may not be a material handicap for a small amount of traffic. In soft, loose sand a temporary roadway can be improvised by carpeting the sand with available desert scrub. This may be done by digging parallel trenches about a foot deep and two feet wide, and then filling them with brush to form a track for vehicles. Another solution is to lay wire netting or fencing. In deep sand heavy, wheeled vehicles can get better traction if blocks of wood are fastened on wheels by chains. All of these expedients were used with considerable success by the British and Turks in their desert operations during the World War.

Every motor vehicle should carry a towing chain or cable, skid chains or similar device, and two planks.

Ordinarily, an advance into hostile territory can be made no faster than the rate of road construction or repair. However, the Italians showed that air transport can replace ground transport at least in part.

The absence of roads, inhabitants, and landmarks in the desert also add to the difficulties of maintaining direction. Isolated patrols and individual scouts must guard against going astray. The designation of zones of action, sectors of fire, and other boundary lines must be made by reference to compass directions together with any usable landmarks. Often it is impossible to specify definite boundaries.

PLAN OF OPERATIONS FOR A DESERT CAMPAIGN

From what we have already seen it is obvious that the two essential considerations in working out a strategic plan of campaign in the desert are suitable water bases and communications. The water bases are of paramount importance and determine not only the strategy to be adopted, but even the feasibility of the campaign. In a desert country where sources of water supply are widely separated, water is often added to the other normal requirements that must be supplied from the rear.

To keep water, food, and ammunition flowing to the front, ample communications are needed. If a railway line is not constructed, enough hard-surfaced roads must be built and maintained to carry the huge volume of trucks required. (A triple lane, hard-surfaced highway connected the northern Italian army with its base.) These two channels can sometimes be reinforced or even replaced by a third, a waterway. Thus did the Nile serve Gordon and Kitchener in the conquest of the Sudan, and the Tigris serve Townsend in the British penetration of Mesopotamia. To Colonel Lawrence and Feisal the Red Sea was especially useful during the early part of the Arab Revolt

when operations were close to the coast. Concurrent with the northward spread of the Arab Revolt was the eastward and later northward progress of British-Egyptain forces from their bases on the Suez; and these forces, hugging the Mediterranean coast, received much of their supplies at ports or roadsteads close to the front. Supplementing these ground and water means is the limited but increasingly useful air medium.

SEASONAL CHANGES

There is usually a certain season when rain falls in desert country. Water then collects in depressions and stream lines so that, for a few weeks, a force can find sufficient water locally to supply its needs. Owing to this fact, campaigns in the desert are often planned to be carried out immediately after the annual rainfall. Thus the Turks, because of the preceding heavy rains, were able to advance by three routes for their attack on the Suez Canal in 1915; but in July, 1916, when water holes were dry, their second attempt was foredoomed. Napoleon had a similar experience, also in the same desert; he crossed the Sinai Desert in winter with little trouble, but his force suffered terribly from sickness and thirst on its return, despite following the best caravan route. So too in October, 1935, the Italians profited by the summer rains. Where they found no surface water, it could be obtained by digging shallow wells.

If the enemy knows the locations and capacity of the natural sources of water within the theater of operations, he can easily foresee the probable lines of advance. One of his first defensive measures is to destroy, divert, or contaminate these local supplies before his adversary can secure them. Indeed, the destruction of the adversary's means of supply is often the immediate objective of each of the opposing forces. Furthermore, when either force withdraws, executes a retirement, or fights a delaying action, it attempts to destroy local water supplies as it executes its retrograde movement. The threat to Aqaba

on the Red Sea occasioned by the movements of Lawrence's Arabs in June, 1917, caused the Turks to destroy the wells at El Jefer. One of these was repaired, however, and the Arab force of 500 camelmen suffered only a temporary delay; and two weeks later Aqaba had passed from Turkish to Arab control.

In the autumn of 1917 *all the future action* of Allenby's command hinged on the rapid capture of Beersheba, a name which signifies "Seven Wells" in Arabic. Without the water supplies at that place farther advance was impossible; the transport from the end of the pipe line at Shellal could not cope with any greater distances.

TRANSPORT AND SUPPLY

For a force of all arms, supply causes considerable difficulty. There are three ways of handling the problem: (1) The force can move as a flying column, taking with it supplies sufficient to last for the period of operation; (2) stores can be pushed forward under guard to points on the proposed line of advance; or (3) convoys can be brought forward from the base. It is extremely difficult for a large force to carry more than three day's supplies with it, particularly if water must also be carried. Carrying supplies for a longer period means an enormous train of trucks or animals. Where this has been done in the past, the number of animals has often more than trebled the number of men.* Pushing stores forward under guard is not often feasible or desirable, though it was done in the successful French campaign of 1934 in southern Morocco. The third method, convoying, combined with rail transport from the base to as far farward as the railway can be pushed, is the most likely procedure for a large force.

The escort of a motor convoy moving to join a fighting

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* There were less than 12,000 men in the entire Napier Expedition into Abyssinia, yet 39,000 animals were delivered to the base at Malkatto.

force should include, if practicable, armored cars and light tanks. The escort of a wagon or pack convoy should be mounted troops.

The use of mechanical transport instead of wagon or pack greatly simplifies supply and enables a force to operate much farther from its base. Since the World War, motor trucks and large airplanes have replaced all types of animal transport wherever practicable in the desert expeditions of the British, French, and Italian forces in Africa and Asia. Similarly, armored cars, light tanks, and attack planes have partly supplanted cavalry and camelry escorts. But where no roads exist and loose sand or broken, mountainous country must be traversed, motor-mechanized convoys stop where road construction stops. This was seen in the creeping advance made by General De Bono and later by General Badoglio, before he began his mobile operations and supply by air.

SIGNAL COMMUNICATION

In the desert, uninterrupted signal communication is even more vital than in other regions owing to the greater importance of supply and the larger area over which operations must usually be conducted. For a large force, wire lines to its base are necessary. Radio or rapid transport is the best link with detached expeditions. To supplement these and supplant them during breakdowns, airplanes, motorcycles, cross-country cars, camel- or horse-mounted messengers, and pigeons are needed. Though now somewhat outmoded, the heliograph was the peerless means of rapid communication in the desert and mountains before electrical "blinker lights" and wireless telegraphy came into being, and even as late as the 1925-26 campaigns in Morocco this device for visual signalling was relied upon by French troops.

THE VARIOUS ARMS IN DESERT CAMPAIGNS

The composition of a force mobilized for a desert campaign should, of course, be determined by the mission,

character of the adversary, and the terrain. It may be governed largely by the water supply and communications. There are, however, certain basic factors affecting the several arms that should be considered in organizing such a force, and for that reason each arm will be briefly discussed as regards its value in desert operations.

INFANTRY

The value of infantry in a desert campaign is identical to its value in any other campaign; it can occupy and hold ground. Yet marching in arid country and especially in heavy sand is very fatiguing; and therefore open formations should be used and none but hardened troops employed. Movement by motors should also be sought whenever feasible. In Morocco, infantry was the primary arm of the French forces. In Ethiopia, infantry, armored fighting vehicles, and aviation were the outstanding arms.

CAMELRY

The camel corps is the true native arm of the desert. Most famous of the fighting camel corps were Lawrence's Arabs. Of his main contingent numbering roughly 3,000 men, the elastic and elusive expeditionary core of scarcely 600 men was a self-contained body, as was each individual man and mount. Each man carried on the saddle enough flour for six weeks, or a "range of over a thousand miles out and home".* The camels themselves amounted to an emergency ration—an "iron" ration, judging from reports on their toughness.

The camel, however, is probably associated more often with the transport corps than with the fighting contingents, because of its use in the supply service of all desert campaigns in Africa and Asia. In Ethiopia the Italian Army had a camel transport corps estimated to contain from 25,000 to 35,000 animals. As a pack animal in desert country, the camel has no equal. His superiority over

* T. E. Lawrence.

other beasts of burden lies in his feet and his stomach; he can travel for days without water, can subsist on the tough, thorny plants of the desert, and the thick callous soles of his feet enable him to travel easily in sand and mud.

The United States Army had a small camel corps in the Southwest, which was organized in 1856, but the Civil War caused this unit to disintegrate and the herd became scattered. At the close of the war, the remaining camels at Camp Verde, Texas, were sold at auction. Other camels were sold to circuses, turned loose, or killed.

CAVALRY

Cavalry, like infantry, can take and hold ground. It is, of course, more mobile and can thus rapidly strike the flank or rear of the enemy. Cavalry has, in the past, played a prominent role in desert campaigns. In fact many of the greatest cavalry actions in history have been fought in the desert. Several of our own mounted regiments boast of their exploits during the troubled years in the Southwest. In the Sinai Desert and arid regions of Palestine, the British, Australian, New Zealand, and Indian cavalry won laurels for their arm in 1917 and 1918. Unfortunately, a horse cannot absorb water like a camel, nor do without it like an aircooled tank. "Time after time the Desert Mounted Corps was faced by the problem of whether to allow a beaten enemy to withdraw and recoup or to founder invaluable horses by continuing the advance without water."*

MECHANIZED CAVALRY

Where the terrain is favorable, mechanized cavalry has many advantages over horse cavalry, primarily in its armor and speed. Armored cars demonstrated their worth against the Senussi of the Libyan Desert in Egypt in 1916

* British Official History.

and 1917. The swift descent on the Girba and Siwa oases in southwestern Egypt in February, 1917, was one of the early exploits of armored cars. This blow was struck by three light armored "batteries" and three light car patrols, which crossed 200 miles of waterless desert, and in an eight day affair, inflicted casualties of 240 men and 40 camels, and destroyed quantities of rifles and ammunition. Three British officers were slightly wounded.

Similarly the Riffian campaign in Morocco and the later operations against the Berbers saw the armored cars of the French forces perform prodigious tasks. They penetrated into hositle territory, protected the flanks of mobile groups, fought as tanks, as rear guards in withdrawals, as convoy escorts, and served as liaison agents between separate columns. A light vehicle was preferred in Morocco, and the "half-track" was excellent in the Sahara.

The combination of scout cars or armored cars operating with cavalry and camelry has, even as with foot troops, achieved excellent results. T. E. Lawrence often shifted from his camel to a Rolls armored car for raids, reconnaissances, or liaison trips. During 1918 there were always several armored cars with his little Arab force. Today the Bedouin sheiks use armored cars to protect the flanks of their tribes when migrating to new feeding grounds.

Among the important reorganizations recently reported to the press by the British War office is the mechanization of the cavalry brigade in Egypt. A tank battalion and several armored car companies are already stationed there, and this further mechanization indicates the high regard in which tanks and armored cars are held for desert fighting.

TANKS

Caterpillar tracks are much better than wheels in deep sand, mud, and rough-going. Tractors and track-laying combat vehicles are therefore well adapted to desert operations. A mechanized force of armored cars and tanks appears to possess the ideal characteristics for de-

sert operations, having high mobility, firepower, and shock action, with a minimum of men and no animals to consume water and food. Its principal items of supply would be just gasoline and oil, and their replenishment for an expedition of several hundred miles would require only an insignificant number of fuel-carrying vehicles compared with the trains needed by an infantry or cavalry column of a force of all arms. Yet we must remember that tanks also have a limit in their ability to traverse rough, broken country.

In the Italian advance to Adowa in 1935, the difficulties of the ground and the inaccessibility of many parts of the hostile positions limited the effectiveness of tanks. In the Ogaden deserts, the terrain was more favorable, and the Italians used tanks to form an advance armored screen for their slower-moving infantry columns, sending them well ahead, 40 or more miles in front, to seize the wells and drive off hostile parties guarding them and the snipers lurking in the vicinity. Tanks thus became the spearhead of the advance. Credit for General Graziani's rapid January drive was given to his armored fighting vehicles.

FIELD ARTILLERY

Artillery like infantry is as useful in the desert as elsewhere. The Turks in 1916 brought four- and six-inch howitzers to Romani over the caravan route by placing mats and palm branches on the ground. Marshall Badoglio, it is said, placed great faith in his artillery. The mobile columns of French troops fighting the Berbers in Morocco contained from three to six batteries as an accompaniment to from four to nine battalions of infantry and two troops of cavalry. These were transported or pulled by motors—both truck and tractor. This means of movement should be used, if practicable, although pack animals may be obligatory in mountainous regions.

ENGINEERS

More often than not engineer troops are vitally important in the composition of a desert force. Railways,

wells, pumping plants, roads, and even bridges must be constructed. In addition, engineers may have the usual tasks of demolitions and battle installations. Field companies of the Royal Engineers, belonging to the British-Egyptian Expeditionary Force (1916-1918) carried twelve complete sets of pumps, water troughs, tube wells, and lining for shallow wells.

CHEMICAL TROOPS

Chemical troops have the same duties to perform in desert operations as in any other. Whether they enter into the composition of a desert expedition depends primarily on the enemy—his fighting methods and tools—and the mission. Against a poorly equipped enemy, such as in an outlaw uprising, an attack with non-toxic gas might well suffice to demoralize the entire band. So, with a large force or a small one chemical troops are ordinarily desirable.

AIR CORPS

Undeniably airplanes greatly aided both the Italians in Ethiopia and the French in Morocco just as the planes of 1917 and 1918 aided the British and Turks in the Sinai Desert, Arabia, and Palestine. This they accomplished by bombing troop concentrations and vital points on the enemy lines of communication, by performing liaison work, and by aerial reconnoitering.

Supplies, as we have seen, can be speedily delivered by air when other agencies of transport fail. Troops may also be rapidly moved by air, wounded evacuated, outposts relieved, raids or reprisals made against hostile elements, and communication established and maintained.

In combination with a flying column of armored cars and tanks engaged in desert warfare, the potential value of aviation can hardly be overestimated. Desert country that is flat offers many natural landing fields so that a mechanized force operating far from its base can readily be supplied by air. Above all else airplanes can serve as

the far-seeing eyes of ground forces, and do this easily, for the desert gives little chance for troops to conceal themselves. With a fast moving mechanized force this long range reconnaissance is supremely important.

Aerial photographs provided the French high command in Morocco with an accurate knowledge of the vital enemy points, such as market places, herds, water sources, fortified villages, and paths of communication. Each of the French "mobile groups" (described later) usually had two flights of planes attached.

EMPLOYMENT OF NATIVES

Hired or enlisted natives are valuable adjuncts to a force operating in the desert just as they are for a jungle or mountain campaign; they know the country, its water-bearing regions, tactical localities, dangerous areas and languages. Furthermore they are acclimated, can circumvent or withstand the hardships of long hours in the saddle or on foot, and know the local expedients for meeting desert problems. The French have made use of native regulars and irregulars as fighting men and scouts in Morocco. The British have employed native Egyptians and Sudanese in the deserts flanking the Nile both as troops and as laborers. There were 135,000 Egyptians in the labor corps of Allenbys' Palestine Army. In encouraging and guaranteeing assistance to the Arab revolt, the British Government acquired an ally who performed miracles under the inspiration, guidance, and deft handling of Colonel T. E. Lawrence. The Ascari (native regulars) in the Italian service bore the brunt of the advance into Ethiopia if the higher casualty rate among them can be taken as a criterion. During our own frontier days, friendly Indians were used both as regular troops and as irregulars. Their ability as scouts won them high esteem among our soldiers.

OPERATIONS OF A SMALL FORCE IN DESERT COUNTRY

Desert operations have almost invariably been fought over wide fronts with widely dispersed forces. Thus we find that, whatever the size of the whole force, the campaign is usually fought by several small columns, each of which must generally operate as a quasi-independent unit. Typical examples are the various components of the Punitive Expedition into Mexico, the mobile groups of the French forces in Morocco, and the subordinate commands of both the northern and southern Italian armies. The reason for this splitting-up may be caused by one or more of the following: irregular terrain, the location of water sources, the available routes of movement, or the methods of the enemy.

We have seeen the difficulties confronting any military force in desert country and how they are met. These difficulties are obstacles to a small force as they are to a large one, but the problems they present are more easily surmounted by a small force. Let us see why this is true.

First and foremost is the dominant item of water. The local sources of water to be found in the desert are more often than not inadequate for a large force, but may be ample for the needs of a small force, such as a mobile group of three or four battalions. The transport and supply problem is simplified accordingly.

Then, too, the supply needs of an army corps are so great that it cannot operate far from a railroad, or from hard-surfaced motor roads. If it advances, the supply routes must be pushed forward also. On the other hand, a force of several battalions can be maintained by motorized trains, upwards of a hundred miles or more from its base. At a greater distance a separate supply convoy and even intermediate bases become necessary. If the terrain makes pack transport obligatory, the supply train for a small force is still no great problem. A small force, moreover, can be supplied by air with a small number of planes. But an army corps, 100-200 miles from its base,

would require scores of freight or transport planes for its class-1 supplies alone.

A further advantage which the small force has over the large one is that it can, in a barren country, march with greater ease, less extension in depth (with its hazards), and more secrecy. It is flexible, can swiftly change direction to meet a flank threat, and can readily deploy for all-around defense on the march and in bivouac.

From this we can see that it is highly desirable to constitute a small force in accordance with the requirements of the particular situation, with every measure taken to strip it of all unnecessary elements that reduce its mobility or add to its supply requirements. An appreciation of this fact and of the particular needs for combating the Moroccan tribes, brought about the French policy of organizing especially constituted mobile groups, separate and distinct from rigid units like the regiment, brigade, and division.

COMPOSITION OF A SMALL FORCE

The armament and tactics of the enemy, his habits, strength, and political situation; the topographical features and water supply of the theater of operations; and the arrangements and facilities, actual and possible, for transport and supply—all of these factors, together with the mission prescribed by higher authority, determine the objective of a force and the composition of a force.

The ideal small force for a desert campaign—terrain permitting—would be a mechanized force, composed of armored cars, tanks, motor transported infantry, motorized engineers, and self-propelled or truck-drawn artillery, with attached aviation. Such a force could well operate as a flying column for three or four days—300-400 miles (150-200 mile radius) or possibly more, without replenishing its primary needs. Rations, munitions, and enough extra gasoline and oil could be carried to meet ordinary requirements. Expeditions covering a longer period would require the establishment of a line of communication unless

air transport were available. Since the World War expansion of aviation, rations and ammunition have been carried regularly by air to border patrols and small expeditionary forces operating in the remote wilds of French and British colonies in Asia and Africa. Gasoline can also be delivered by parachute if necessary, as has been done on many occasions in recent years.

On the other hand, in areas of heavy sand and dunes or in mountainous regions, motorized columns are severely handicapped. In such areas, the composition of the force must be stronger in regular infantry, or else in cavalry or camelry. Similarly part or all of the transport must be by pack. Though mechanized elements might be restricted, the air corps should still be able to operate porvided landing fields can be found reasonably close to the scene of operations.

Typical of small mobile forces operating in a region combining the characteristices of mountain and desert is the "groupe mobile" of the French Moroccan Army, which in reality is a mixed brigade of the Alpine type. Quoting from "La Guerre au Maroc" by Lieutenant Colonel Lorillard, we have its composition briefly stated.

"From three to six battalions (infantry) strong, and intentionally mixed (Algerian, Moroccan, and even Sengalese and Foreign Legion) and generally containing a platoon of accompanying weapons in each—from two to three troops of cavalry—from three to four batteries of 65's or of 75's—and with an engineer detachment, reprovisioning itself from an advanced base (or, in case of a deep advance, from an auxiliary base), the mobile group has everything necessary to fight offensively or defensively, to open trails, establish signal communication and to establish stations, as well as to hold out for a long time."

* * * * * * *

" . . . The mobile group is always well provided with means of transport and its services (signal, artillery, engineers, supplies, medical, veterinary, military police, chaplain, finance, and postal) are fully equipped."

In 1932 the Confins—Saharan mobile group, one of the largest, comprised:

6 infantry battalions
2 artillery groupments
5 cavalry *escadrons* (troops)
1 light tank company
1 motorized squadron
1 motorized mounted company
2 aviation *escadrilles* (10-15 planes each)

Its total strength at the time was 9,000 of all ranks, including 1500 irregular native troops, and 3,000 animals. The Marrakesh mobile group had:

7 infantry battalions
7 artillery batteries
2 cavalry *escadrons* (troops)
2 aviation *escadrilles**

In the highly successful French campaign of 1934 in the Anti-Atlas and western Sahara region of southern Morocco, the groupement under General Giraud, which made a record in desert operations, contained 14,000 men, 4,700 animals, and 400 motor vehicles. It comprised—

8 battalions infantry, three of which were motorized.
1 Saharan company.
1 camel company.
5 *escadrons* (troops) cavalry (3 Spahis, 2 Legion).
7 motorized units—
  2 automobile companies, each having 2 armored car sections and a carried company.
  5 troops armored cars.
1 *groupe* tractor-drawn 75-mm.
1 *groupe porté* 75-mm.
1 *groupe* 65-mm mountain guns.
1 battery 80-mm (apparently mortars but translation did not specify).

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* The data on these two mobile groups is taken from the article "The French Campaign in Morocco" by Colonel Frank E. Evans, U.S.M.C. in the January, 1934, United States Naval Institute Proceedings.

2 companies Legion pioneer sappers.
7 *goums* (native contingents).
3,500 native irregulars.
2 squadrons aviation.

This force operated in two parts, each of which was often split into several sub-groups. The success of these groups was due to "speed and surprise" and "to the intervention of motorized units and to their employment in mass," says Colonel Arlabosse in *Une Operation Moderne en Afrique du Nord*, Revue Militaire Francaise, April, 1935. He also adds, "It is no longer conceivable that detachments will operate in the Sahara without automotive means and without aviation. Not that one can replace the other. The cameliers patrol in regions inaccessible to the automobile."

These are sizeable forces. Smaller groups were often constituted. It must be borne in mind that the Spanish campaign against the Rifis from 1921 to 1925 and French campaign of 1925-26, partly supported by the Spanish troops, were both waged in mountainous desert country. The plains and the valleys of the mountains were the only parts that could be traversed by the motor cars or tanks of that time. Yet the tanks and armored cars on more than one occasion demonstrated their effectiveness. In August, 1925, tanks contributed largely to the capture of the hill of Asjen—a short distance from the town of Wazzan. (See Figure 17.)

The notable feature of the mobile group is that it is mainly built around the infantry battalion. "With the battalion as the organic unit the mobile group is endowed with a mobility and suppleness of employment that permits its expansion or contraction at will, its division into groupments, and its immediate breaking up into columns and detachments as occasion requires."* The adoption of this organization by the French was the result of years of experience in Morocco. The terrain and difficulties of

* Colonel Frank E. Evans, U.S.M.C., in United States Naval Institute Proceeding, January, 1934.

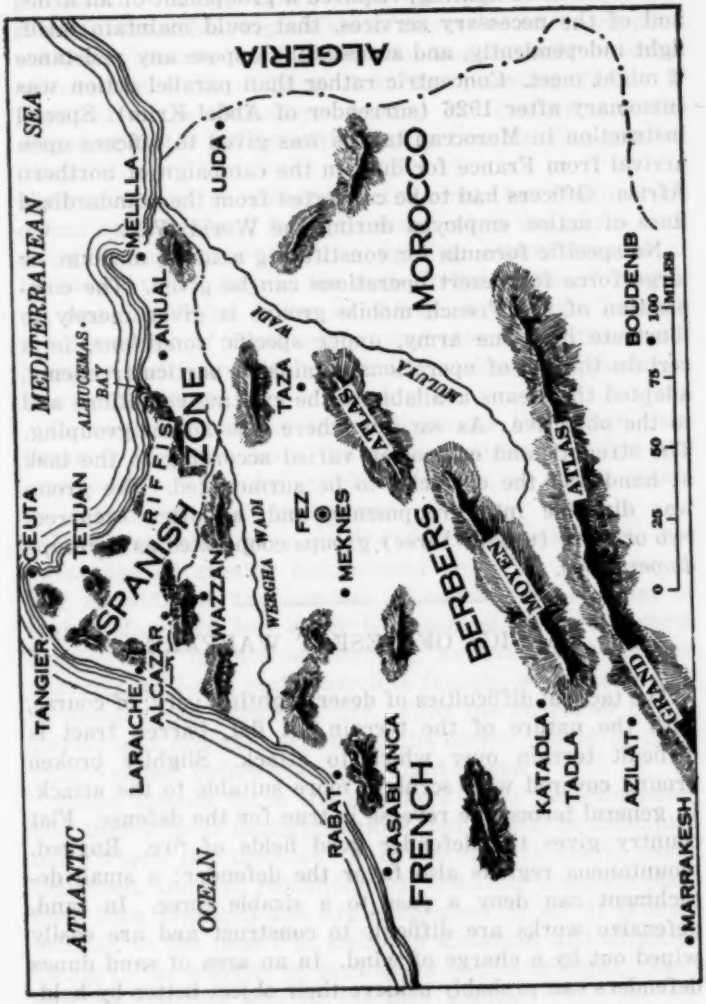

FIGURE 17.—Morocco.

supply, coupled with the character of the enemy, his habits and methods of fighting, required a groupment of all arms, and of the necessary services, that could maintain itself, fight independently, and successfully oppose any resistance it might meet. Concentric rather than parallel action was customary after 1926 (surrender of Abdel Krim). Special instruction in Moroccan tactics was given to officers upon arrival from France for duty in the campaign of northern Africa. Officers had to be converted from the standardized lines of action employed during the World War.

No specific formula for constituting a small, medium, or large force for desert operations can be given. The composition of the French mobile groups is given merely to illustrate how one army, under specific conditions, in a certain theater of operations, against a particular enemy, adapted the means available to the existing conditions and to the objective. As we saw, there was no set grouping. The strength and composion varied according to the task at hand and the obstacles to be surmounted. The group was divisible into groupments, and, as often occurred, two or more (usually three) groups cooperated as a *groupe d'operations.*

TACTICS OF DESERT WARFARE

The tactical difficulties of desert fighting vary, of course, with the nature of the terrain. A flat, barren tract is difficult terrain over which to attack. Slightly broken ground covered with scrub is more suitable to the attack. In general terms, the reverse is true for the defense. Flat country gives the defender good fields of fire. Rugged, mountanous regions also favor the defender; a small detachment can deny a pass to a sizable force. In sand, defensive works are difficult to construct and are easily wiped out by a charge of wind. In an area of sand dunes defenders can probably achieve their object better by holding their lines with mobile troops; for an attack will always be a difficult and disjointed operation against which a

vigorous counterattack by fresh troops may well prove successful. Country where water sources are widely separated favors a delaying action on successive water supplied positions, because the defender can keep himself provided with water while denying it to the pursuing force. If practicable, the defenders destroy or contaminate the source of water before withdrawing thus causing greater delay.

A withdrawl or delaying action may be a dangerous operation for a small force, however, when the enemy uses guerrilla tactics or has the fighting characteristics of barbarous tribes such as the early Indian tribes of America, and the desert tribes of Africa and Asia. To such peoples a sign of weakness is noted almost intuitively and becomes their signal for a terrific onslaught against isolated detachments.

In summer, marches should begin no later than daybreak in order to reach the day's destination before the terrific heat of mid-day is felt. Similarly, an attack should be initiated at dawn or before.

Night marches have, in the desert as elsewhere, the advantage of greater concealment from air observation, and in addition, the comfort of coolness that comes at night. Moreover, less water is consumed—a factor worth considering. In hostile country, however, and against guerrilla tactics, a night march is fraught with the danger of ambush and harassing fire. Thus the character of the terrain and probable actions of the enemy should be carefully weighed before making a night march.

Night attacks spare the attackers from the exhaustion and hardships of daylight actions, but should be attempted only where the distance to be covered is short, easily traversed, and well reconnoitered, and after complete plans have been prepared and are understood by all. It is more difficult in the desert to maintain distances and direction owing to the scarcity of landmarks visible at night. Stars and the compass may be the only guides.

As a rule, a small force marches, bivouacs, and fights with its transport and supplies and other vulnerable ele-

ments centrally located within its component infantry and cavalry elements. Enemy thrusts may be delivered from any direction, particularly if the enemy himself is highly mobile, thanks either to animal or motor transport; hence the vulnerable parts of a force must be given all-around protection.

Before, during, and after an offensive operation, reconnaissance by air and ground agencies must be constant and thorough. Assuming that the demoralization, disruption, or destruction of the enemy is the immediate objective of the expedition, his location, movements, strength, and equipment must be known. When adequate information has been obtained, the force constituted, and all preparations for transport and supply have been completed, the expedition must move swiftly and aggressively. Delay and vacillation not only encourage the enemy and demoralize our troops, but intensify, in desert country, the difficulties of supplying water and other provisisions.

Here again it is well to repeat that the enemy will endeavor to deny water supply points to our force, and the situation may in turn require our force to make a determined effort to deprive the enemy of his water base or bases. The belligerent without water must either attack, retreat, or surrender—to defend is hopeless. The most effective measure to stop a hostile advance or break a stubborn defense is to deny water to the enemy. Thus the immediate mission of both belligerents may be an offensive action to secure the existing water bearing areas. The campaign may thus become similar to a race between hostile states to secure the passes of a mountain frontier, or bridgeheads on the river separating the two countries.

Moreover, if mobility and freedom to pursue a defeated enemy are to be preserved, every success must be rapidly exploited to prevent the enemy from destroying any local water supply within his lines. Thirst is the passive foe of both belligerents but can be made the powerful ally of the one who best appreciates this fact and lays his plans most adroitly to exploit it.

We have examined the "groupe mobile" of the French

Moroccan Army. Let us study briefly what Lieutenant Colonel Lorillard says in "La Guerre au Maroc" on the action of the groupe mobile.

"The disposition of a mobile group is invariable. It is the famous square of Bugeaud, the 'diamond-shaped' or 'pig-head' formation, with the four faces made up by the advance guard, flank guards, and rear guard, and with the center occupied by reserves, trains and convoys. This disposition realizes in itself, as is self evident, the maximum security against an adversary that may pop up from any of the points of the compass.

"The commander of the mobile group is the one to give these diverse elements a composition appropriate to the information obtained, the dangerous direction, and the terrain. For example, a flank guard should be strongly organized and reinforced if an attack is to be expected on its side; similarly, the rear guard should be augmented and given powerful support if the force is making a retrograde movement."

Figure 18 shows schematically the disposition of a mobile group composed of five infantry battalions, two cavalry troops and three artillery batteries which are advancing against an enemy believed to be in front—the normal case.

The disposition shown in this sketch cannot, of course, be rigidly maintained at all times and in all places along the route of advance. An accordion effect both lengthwise and crosswise is unavoidable. The allowable extension depends on enemy activity and the topography of the region traversed.

There were occasions in Morocco where a mobile force as here depicted advanced in two echelons, the strongly reinforced advance guard advancing first and occupying a new position; the rest of the group subsequently joining the advance guard on the occupied position.

Oftentimes, a mobile group was obliged to act with utmost rapidity. On these occasions, it dispensed with all but the irreducible essentials in the way of impedimenta, by eliminating baggage, tents, reserves of food and

materiel, and only carrying its ambulance, munitions and necessary food. It camped "a la saharienne".

It should not be assumed that the tactical disposition of the "groupe mobile" is applicable to all forces, nor that this type of force is suitable for all warfare in the desert. It is merely given as an illustration of the solution reached by the French Moroccan Army in its campaign against the dissident tribesmen in the barren regions of the French protectorate. It is, however, recognized by most European armies to be the most satisfactory formation for colonial warfare on the wastes of Africa and Asia.

The dispositions adopted by a force when halted must be such that it has all-around protection as shown in the formation and disposition of the French "groupe mobile". At night, in the presence of the enemy, measures must be taken to forestall raiding parties and to secure defense against an attack in strength. When thick scrub exists it is necessary to clear fields of fire, using the material as an obstacle. When there is no scrub an earth parapet should be made. The location of the bivouac is important; it should afford good fields of fire, and if possible offer the enemy no covered approaches. A near-by source of water is of course to be sought. Every member of the force must know his alarm post and be able to reach it rapidly. Two- or four-man posts at intervals, several hundred yards outside the perimeter of the bivouac, are established to give timely warning of a hostile approach. In broken or mountainous regions, these posts should be on points dominating the camp and its environs, and should be garrisoned by larger outguards to deny them to enemy elements. When an eminence can be occupied by the bivouac itself the problem of defense is simplified.

In hostile country where defensive measures are taken by siting machine guns to cover the sides of the bivouac, a guard must be on the alert at each gun with definite instructions on his action in case of enemy attack. Subordinate elements, charged with the defense of part of the perimeter of the bivouac, post sentinels in their sectors. Where the force is dependent on a water source near the

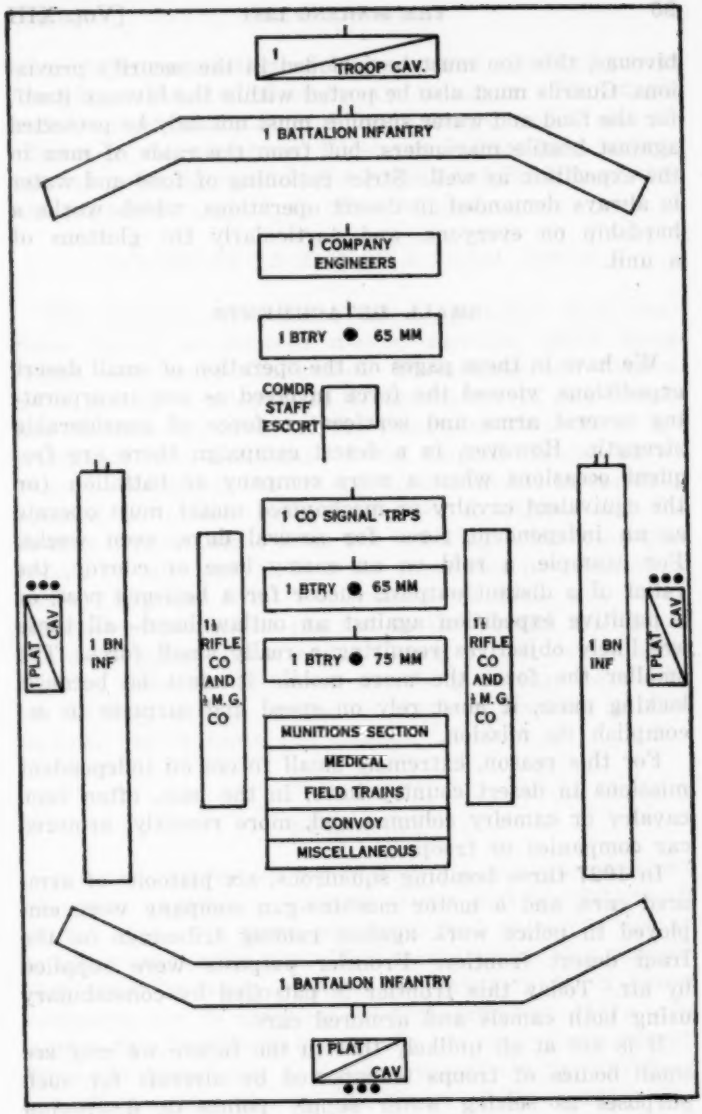

FIGURE 18.—Disposition of *groupe mobile.*

bivouac, this too must be included in the security provisions. Guards must also be posted within the bivouac itself, for the food and water supplies must not only be protected against hostile marauders, but from the raids of men in the expedition as well. Strict rationing of food and water is always demanded in desert operations, which works a hardship on everyone, and particularly the gluttons of a unit.

SMALL DETACHMENTS

We have in these pages on the operation of small desert expeditions, viewed the force involved as one incorporating several arms and services; a force of considerable strength. However, in a desert campaign there are frequent occasions when a mere company or battalion (or the equivalent cavalry or mechanized units) must operate as an independent force for several days, even weeks. For example, a raid on an enemy base or convoy, the relief of a distant outpost, succor for a besieged post, or a punitive expedition against an outlaw band—all these are likely objectives requiring a really small force. The smaller the force the more mobile it must be because, lacking mass, it must rely on speed and surprise to accomplish its mission.

For this reason, extremely small forces on independent missions in desert country have, in the past, often been cavalry or camelry columns and, more recently, armored car companies or troops.

In 1927 three bombing squadrons, six platoons of armored cars, and a motor machine-gun company were employed in police work against raiding tribesmen on the Iraqi desert frontier. Frontier outposts were supplied by air. Today this frontier is patrolled by constabulary using both camels and armored cars.

It is not at all unlikely that in the future we may see small bodies of troops transported by aircraft for such purposes as seizing water supply points or destroying those available to the enemy and also to relieve a besiged outpost. Nor is it improbable that an air attack might

be made in conjunction with the ground attack of troops brought to the battlefield by air transport. The supply and eventual evacuation of such troops would also be effected by the air corps. These possibilities have already been successfully tested in the British and Russian armies, and, to a lesser extent, in other armies.

RESUME OF TACTICS OF A SMALL FORCE

The characteristics of the desert operations of a small force should be directed toward surprise, rapid movements, and aggressive action. Formations and dispositions should be adopted to fit the nature of the terrain and the security needs of the vulnerable elements of the command. The accidents of the terrain should, as always, be utilized to the utmost. Routes should be carefully selected to obtain water wherever it exists, and the bounds that are made from one watering point to another should be calculated to keep the expedition provided at all times with this vital requirement of man and beast. Marches must also be planned so that troops are spared the debilitating effects and suffering of the desert heat; that is, there should be no marching during the middle of the day. Lastly, camps or bivouacs must be secured against hostile raids and attacks.

SUMMARY

A desert is a barren region destitute or almost destitute of water, vegetation, communication, and population. It cannot support a large population and therefore not an army, whatever its size. This is the underlying thought that must be borne in mind in preparing for a desert campaign and in carrying out that campaign. In a wild region, the inhabitants are usually like their surroundings. Thus the commander of a desert expedition has to defend himself not only against the rigors of the country, but also, in most cases, against a fierce and determined, but withal a crafty enemy. More often than not the enemy's

methods are those known as guerrilla tactics, which must be met largely in kind. But that is another subject.

Success in desert warfare, in even greater degree than elsewhere, is dependent on mobility and supply. Mobility is gained by stripping a force of all non-essentials and by providing it, terrain permitting, with rapid transportation.

Be the force large or small, it must be supplied; and its supply, water included, is the counterpoise against which every plan of operations must be balanced before making a decision.

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CHAPTER 4

The Regiment Withdraws

(INFANTRY SCHOOL TEACHING)

During a lull in the savage fighting, S-3 made a perfectly unnecessary overlay of the regimental position. He traced in the two front-line battalions and the 3d Battalion on the regimental reserve line. He carefully sketched in the locations of the platoons of the Mortar Company acting in general support; and also the positions of the 0.30 caliber machine-gun companies, each of which was attached to a rifle battalion, and the 0.50 caliber machine-gun company which, for antitank defense, was scattered throughout the position. He winced unconsciously as he noticed the radical changes which had taken place since morning. To keep from thinking any more in this direction he sketched in the streams, woods, and roads. When finished he had a fair map except for the lack of contours and scales. (See Figure 19.) He sighed when finished and his mind took up the tale of the day.

It had been a hard and exhausting day. Things had not gone well with the regiment. It had tried mightily but the enemy was too strong. A succession of determined attacks had been difficult to stop. In fact in certain places they had not been stopped. Desperate counterattacks had restored the position in part, but losses had been heavy. At the present time all elements of the regiment were occupying their prepared positions. Renewed attacks could be expected tomorrow on the right, thought Greene, the S-3—particularly in view of the precarious situation in the sector of the adjacent 92d Infantry. It was hanging

on by an eyelash. If it gave way the 91st Infantry was due for a frightful licking tomorrow. The 91st could hang on today, but tomorrow—— But S-3 did not like to think of tomorrow.

To the front he could hear the frantic chattering of the machine guns, the irregular sound of rifle fire and the solid roar of artillery. To the rear he could hear the supporting artillery trying its best to help. The sound alone indicated that it was outmatched. It did not need the whine of incoming shells seeking out the battery positions to tell him that. He was new at this game but already he knew the difference in sound between shells coming or going. Before his eyes a stretch of dusty road turned over on itself and threw up, geyser like, a great plume of dust. A direct hit on the crossroad, he thought. And that was no small shell. The enemy was lobbing over big stuff. What the hell! Was he bringing his whole GHQ reserve artillery to play on this one brigade? What would happen tomorrow? Cripes, would he never stop thinking of tomorrow. But the refrain, "tomorrow, tomorrow, tomorrow" kept ringing in his head.

Look at the Old Man there calmly chewing on a cigar. Was he as calm as he seemed? Lord, S-3 thought, what a lucky break it was to get a guy like him. Glad he relieved old Bustard. Bustard would be having a cat-fit by now. No, that wasn't true; Bustard would have no regiment by this time. If the regiment had anyone else but the Old Man commanding, the enemy would be mopping up the division command post right this minute. Wonder if the Old Man is thinking of tomorrow? There it goes, tomorrow, tomorrow, tomorrow. Why worry about tomorrow, the chances were he wouldn't see much of it. Yes tomorrow—— The shrill trilling of the telephone, at his elbow interrupted him. Well, he thought, as he reached for the phone, the enemy artillery couldn't keep the wire lines out for long. Good lad that fellow Johnson with communication.

"Yes," he said, "this is Magic 3 speaking. In thirty minutes. Very well I'll notify the colonel."

"What's in the wind?" asked the Colonel, surveying carefully the pulpy end of his cigar.

"The brigade executive states that the brigade commander has decided to withdraw to a new defensive posi-

FIGURE 19.—Dispositions of the regiment.
(not drawn to scale)

tion under cover of darkness tonight. Brigade S-2 will be here in about 30 minutes with oral instructions. About the only thing definite so far is that each regiment will provide its own covering force."

"Wise old coot our general," the Colonel thought silent-

ly, "I have been waiting for that." Then he continued aloud.

"Well let's look the situation over and see what we can do in advance of any definite instructions."

"Colonel," asked S-3, "who will command the covering force?"

"Get Jones, the 2d Battalion commander. I have been watching him closely. He is level headed, cool, and the most energetic field officer we have. He has enough initiative to swing the job all by himself if he gets into a jam or communication goes bad."

"Why not use the regimental executive. He is all that Jones is, and more."

"Think it over," the Colonel smiled quietly at S-3. "Somebody has got to look over the new defensive position and make decisions back there. My place is here until the withdrawal begins. The Executive is my second in command and he is the one to carry out the general plan for occupation of the next defensive position. He can't be spared."

"Colonel," S-3 spoke hastily, "how about the other battalions? We have only about four hours of daylight left, and in this time the battalions must——"

"Whoa not so fast. You anticipate everthing—that's good of course—but don't interrupt so much. Let me struggle along and if I miss something you plug the gap. Sure, I know the battalions must, during the remaining hours of daylight, reconnoiter for assembly areas, for routes to assembly areas and to the new position, and also, reconnoiter the new position itself. I'll miss a lot of the details but you keep that steeltrap mind of yours on them and snap them up for me."

There was a twinkle in the Colonel's eye that took any sting out of the remark. S-3 did not know whether he was being admonished or chaffed. Just like the Old Man he thought, to razz someone a little when all hell was breaking loose. He smiled sheepishly, cocked his head on one side and watched the Colonel with round eyes, for all the world like a bird. Strangely enough, no thought of tomorrow flitted through his mind.

With a half smile the Colonel continued, "See if you can pick a hole in this: Direct the commander of the 2d Battalion to turn over his battalion to his executive officer and report to me here, ready to take command of the covering force. Inform the other battalion commanders of the impending withdrawal tonight. Direct each rifle battalion to collect two guides from each of their companies and attached units. Have these guides and a battalion representative stand prepared to move to the rear on reconnaissance. Have the 4th Battalion organize a rearward reconnaissance group. Inform the rifle battalions that a regimental staff officer will bring them withdrawal orders after we receive instructions from the brigade, but to send a representative here."

"Does that cover things so far?" asked the Colonel.

"Yes, but what about supply and communication?"

"That is just coming up. Direct the communication officer to report here. Tell him that he will provide a communication detail for the covering force. It's a trifle early for S-4 to get a detailed plan for feeding the regiment, or a plan for disposing his transportation. That will have to await the brigade order, but he better be getting a start on his plan now."

"Furthermore," continued the Colonel, "issue all the instructions, get hold of the officers that are to report here. Have them present in 45 minutes. Inform the staff. Get the wheels rolling and make it snappy. I want to confer with the Executive. Have all staff recommendations ready when I return."

Almost at once all telephones are being used, runners speed from the command post. The wheels begin to turn even before the Brigade S-2 arrives.

Shortly thereafter Jones, from the 2d Battalion, came in like a gust of wind. Looking over S-3's situation map he whistled softly as he saw the precarious condition of the brigade front. In a nervous energetic manner he commenced to make notes. It was easy to see that he felt that any mis-step during the withdrawal would lead to disaster.

The Brigade S-2 arrived and a small group gathered around the S-3 situation map, where the Brigade S-2 issued overlays showing the new defensive position and the zones of action of each regiment. The group included the Brigade S-2, the Regimental Executive, Jones, the commander of the 2d Battalion, S-3 with his everpresent pencil and notebook, and the Colonel himself still rolling and chewing the remnants of his cigar.

S-3 with his pencil poised over his notebook ready to go, looked with a grin at the Colonel, who was again surveying, with what appeared deep sadness, the chewed end of his cigar. That is just like the Old Man, he thought, even at this critical period he appears unruffled. He would probably fondle that wreck of a cigar stub all during the time the brigade order was being issued. One would think that he was paying little attention. Yet, when the order was completed, he would have everything at his finger ends; he would cover any point not plain with a few terse questions and then give a clear, concise order that would cover the entire subject, without waste of words or any ambiguity. Speed in perception, speed in decision, clearness in orders, speed in carrying them out but no haste anywhere, and calmness everywhere. That about summed up the Old Man. His staff was a tool that he used to do his work, not a military council. But the Brigade S-2 was reading the order and S-3's pencil started to fly over the paper.

What he got into the pages of his notebook was the following.

That the brigade will withdraw tonight with regiments abreast to a defensive position along the line * * *.

That the present boundary between regiments will be extended to include the new defensive position.

That both regiments will withdraw simultaneously, with front line battalions commencing the withdrawal at 8:30 PM.

That each regiment will cover its withdrawal by leaving in contact with the enemy a covering force not to exceed the equivalent of two rifle companies and two platoons of

heavy machine guns under command of a designated officer. The covering forces will hold their present positions without adjustment until 1:00 AM, and then withdraw simultaneously within regimental zones of action.

That the artillery will withdraw simultaneously at 8:15 PM in zones of supported units. One battery per battalion of light artillery will remain in position until 1:00 AM in support of each regimental covering force. Artillery will have priority on roads.

The 3d Battalion 92d Infantry (brigade reserve), with attached units, will outpost the new position with outpost line along the general line * * *.

That all elements of the brigade will clear the new outpost line by 3:00 AM.

The Brigade S-2 stopped. There was a slight pause and then Brigade S-2 added, "Any questions, Colonel?"

"I presume," the Colonel said, "that the brigade commander did not designate a brigade covering force directly under his control, because he judged time is so limited, the brigade frontage is so great, and the country is too thick to permit adequate control?"

"Exactly."

"That being so, how will the withdrawal of the artillery and infantry be coordinated?"

"It will be necessary," Brigade S-2 replied, "for you and the artillery commander in your sector to coordinate your movements. The regimental boundaries have been extended to include the new position and in such a manner that you have a reasonably good road net in your sector."

"Quite so," the Colonel replied, "but here is another point: The brigade order says that the regimental covering forces will withdraw simultaneously at 1:00 AM. Suppose the situation at that time demands a delay. How does the brigade commander hope to effect a change in the orders?"

"That is an important matter and I do not understand how I overlooked it for the moment. Here is the set-up: a brigade staff officer will remain at the location of the brigade CP until the covering force starts to withdraw.

The brigade communication officer will maintain the wire lines from the present brigade CP to the present regimental CP's. He will also run a line from the present brigade CP to the new one. The detail is laying the wire right now. The wire lines will be left in as they are at present. If you establish your covering force CP at your present regimental CP, the brigade should be able to maintain some degree of control over the withdrawal."

"One more question," said the Colonel, "and I think we will be through. My executive officer is going back in a short while to the new position. What brigade representative will you have in that area?"

"The brigade executive will be at * * * after 4:30 PM this afternoon. He has the general's authority to make any decisions which may arise."

"Oh yes! I nearly forgot—the General said he would visit each regimental CP before dark. Good luck, Colonel." The Brigade S-2 saluted and moved away. As he passed S-3 he leaned over his shoulder and spoke softly in his ear, "Now don't get lost tonight, Shrimp."

S-3 grinned impishly and, when the Brigade S-2's back was turned, thumbed his nose at him. Fortunately the Colonel's back was also turned, as he watched the staff officer get into his reconnaissance car. Perhaps the Colonel would not understand that S-3 was the coxswain and Brigade S-2 was stroke oar of a winning crew at Poughkeepsie.

"Well Greene," said the Colonel turning to S-3, "things are looking up. So far our planning is sound. Now to tuck in a few loose ends before I take up matters with the covering force commander and the Executive."

The Colonel studied the map for a while and then said, "Get in touch with the battalions and direct those reconnaissance groups to start to the rear at once. They will report to the Executive at * * * . Direct the artillery battalion to send a representative over here right away. Tell the artillery I would like the battalion commander's plan of withdrawal and supporting fires; and his recommendations for artillery routes of withdrawal.

Acquaint the remainder of the staff with the brigade order. I suppose that this order has already been given to the artillery by the brigade but you had better check on that too. Direct S-4 and the communication officer to be prepared to make recommendations in a few minutes."

Then turning to Lieutenant Colonel Jones, commanding the 2d Battalion the Colonel said: "You have the toughest assignment possible in war. You have heard the brigade order. Study the situation map there and think the matter over and be prepared to discuss your problem with me when I call on you."

With the Executive Officer, the Colonel studies a map covering the available routes of withdrawal and the location of the new position. There was silence for a time and then the Colonel rapidly sketched his method of withdrawal to the Executive and a tentative plan for occupying the new position. Finally he straightened up and said:

"You have my plan of withdrawal and my tentative plan for the occupation of the new position. Go back and meet those reconnaissance parties. Make a thorough reconnaissance of the new position and the routes leading into it. Be sure the guides know how to lead their companies over the routes of withdrawal and onto the new position. These guides will have to ascertain their battalion assembly areas when they return to their units. When you have issued the necessary instructions return here."

"Suppose I find that your plan of defense does not exactly fit the terrain?" asked the Executive.

"I said the plan of defense was a tentative one. If you have to make changes to fit the terrain, go ahead and make them. Since you understand my plan that's all that matters. We can't change contour lines but we can change plans to fit them. That is your job. Go to it 'Bill'." The Colonel waved him away.

Turning to S-3 he called out, "Has that artillery representative arrived yet?"

"Yes sir, and we also have representatives of all the battalions."

"Send the artillery representative over here," directed the Colonel, "and meanwhile gather up the other representatives and explain the situation to them."

The Colonel conferred briefly with the officer from the artillery battalion staff, and found that there would be no conflict with the artillery when his units moved out, and adequate support would be given to the covering force. He arranged for artillery liaison with the covering force. At the conclusion he directed S-3 to bring the unit representatives over to him.

"Gentlemen," he said, "we have a damned difficult operation to carry out tonight. It will call for all our common sense, activity, and spirit of cooperation. The order which I am about to give you is in a sense a fragmentary one. It will be supplemented later, but even now you will have sufficient on which to base your plans. Supplementary orders for the occupation of the new position will be given out when the Executive returns. S-3 will issue a written order for the withdrawal as soon as time permits. But we can't wait for that and you must be able to make the move out of your positions with the knowledge you get here. Everyone take such notes as are necessary and be prepared to ask questions if matters do not appear clear to him.

"You are familiar with the brigade order.

"We withdraw tonight commencing at 8:300 PM. The withdrawal will be simultaneous for all units.

"Lieutenant Colonel Jones will command the covering force. This force will not exceed the equivalent of one rifle company and one platoon of heavy machine guns attached, in each rifle battalion sector. Troops selected to constitute the covering force will remain in their present positions. No readjustment is contemplated. Lieutenant Colonel Jones will assume command of the covering force at 8:00 PM tonight. The covering force will hold its position until 1:00 AM and then withdraw as directed by Lieutenant Colonel Jones.

"Battalion commanders will select and report locations of assembly positions for their battalions. Routes of with-

drawal are being reconnoitered by guides from the companies. Each battalion will withdraw by routes to be announced later.

"Units of the 4th Battalion attached to rifle battalions (less elements with the covering force) will remain attached during the withdrawal.

"The 1st Battalion 46th Field Artillery (less one battery) will withdraw at 8:15 PM to positions in the area * * * . One battery will remain in position until 1:00 AM in support of the covering force. Artillery will have priority on roads.

"Administrative details will be furnished later.

"The communication officer will provide communication between the regiment and the covering force, and within the covering force.

"I will be at this CP until 8:30 PM.

"Now for a little check." He turned to the 4th Battalion commander, "Certain trucks will have to be left for the heavy machine guns with the covering force. What is your plan for that?"

"I expect to leave these trucks initially at the assembly positions of the 1st and 2d Battalions. Jones will know where they are and can move them later as he sees fit."

"Does that suit you, Jones?" asked the Colonel.

"Yes, it sounds OK."

"So it does; but, Jones, be sure that you know exactly where the assembly positions of the 1st and 2d Battalions are located. Battalion representatives of the 1st and 2d Battalions will see that the covering force commander is notified immediately their battalion assembly positions are selected.

"Jones, how do you plan to determine what heavy machine guns will be left in support of your covering force and where these guns will be located?"

"I believe," said Jones, "that the decision as to what guns to leave and where to leave them should be made by the rifle battalion commanders and the commanders of attached heavy machine-gun companies. After all, they know the critical areas and the proper guns to cover them."

"That's approved," said the Colonel, "Also, rifle battalion commanders will be responsible that the information regarding these guns gets to the covering force commander, and that the officers left to command them get in touch with him. He can be reached at this CP."

"Unless there are further questions," continued the Colonel, "unit representatives will move out at once. The staff and the covering force commander will remain."

While the bustle of departure was still going on, the Colonel turned to S-4 and asked,

"What is the supply situation and your recommendations for the withdrawal?"

"We are in good shape both in regards to class-I and ammunition. I recommend that enough ammunition be left with the covering force to see it through the night. I calculate that one day of fire will be plenty. The rest of the ammunition will be carried back on combat vehicles or individuals.

"I propose we release enough kitchen trucks to the CO of the covering force so that he can feed a hot supper on the position. I shall make arrangements with him later at his convenience regarding the details. The covering force can get breakfast in rear of the new position in the morning. There isn't time to feed the remainder of the troops before withdrawal begins, so I suggest we arrange to have a hot supper waiting for them when they arrive on the new position. I'll see that they also get a hot breakfast and a cold lunch before daylight tomorrow.

"From the map, I have selected a possible location for the ammunition DP at * * *. I will dump a load on the new position as soon as possible after dark. With what the troops carry back that will make approximately two days of fire. The surgeon has recommended a new regimental aid station at * * *. I'm sure these points will be satisfactory, but will check up on them while making my reconnaissance.

"The evacuation system, although under a strain, is working well. The surgeon has asked the Medical Regiment to clear all of his aid stations of wounded by 8:00

PM, and I can furnish the transportation they need to evacuate any casualties that may occur after that. We wouldn't like to have any of our wounded fall into the hands of the enemy.

"Colonel Jones has asked that his own battalion surgeon be left as surgeon of the covering force. His surgeon will have not only his own regular personnel but some additional litter bearers as well."

"Very well," interjected the Colonel, "I want the covering force to get as efficient medical service as the rest of the regiment, and it sounds like they will. Proceed."

"I can start the regimental trains to the rear at dark. They will not interfere with either the artillery or other troops, because they are in rear of them now and can move as fast as, or faster, than the other echelons.

"As soon as I can I must make a reconnaissance for a new bivouac for the trains. I'll keep in touch with the Executive on the new position and will work through the battalion supply officers to see that there are no delays in supply movements."

"The plan is approved," the Colonel stated. "Move out at once, but do not fail to keep in touch with this CP in case conditions should arise that will necessitate changes in your plan."

The Colonel turned to the communication officer.

"Johnson, you have heard all the orders and know the plan. What is your recommendation?"

"I recommend that the present regimental and front-line battalion CP's become the CP's of the covering force commander and his units. That is, of course, providing there is no tactical reason why they shouldn't be."

The Colonel turned to Jones who was standing by, "You will fight the covering force tonight. What is your opinion about that?" he asked.

The covering force commander nodded and said, "That suits me exactly."

Turning again to the communication officer the Colonel said, "That is settled and approved. Continue."

"I can leave one phone at the regimental CP to connect

with the old brigade CP; brigade will maintain that line. A second phone at the regimental CP will connect with the two front line battalion CP's which will be taken over by the covering force. I can leave one operator at regiment and one man to maintain each of the two forward lines. Two messengers should also be left with the covering force commander."

"Will you have enough wire left to install communication in the new positions after you abandon our present wire installation?" the Colonel interrupted.

"I have already arranged to get wire replacement from the division," replied the communication officer. "As for the telephones, my own men will operate them. The phones will get back if the men do."

"Jones," said the Colonel, turning to the covering force commander, "do you think that the communication set-up is satisfactory for your force?"

"It's better than I expected, I shall not have to draw very heavily on my covering force," Jones replied with a grin. "But what about my communication with the artillery?"

"The artillery will have a liaison detail with radio report to you at 8:00 PM. It will remain with you until the covering force passes the outpost line of the new position. I have arranged all that," the Colonel replied.

"In that case," said Jones, "I think my covering force is very well taken care of."

"That is all for you, Johnson," the Colonel said, "now get things started.

"Jones, since you will be taking over the front-line units, and since the order directs that troops selected for the covering force will remain in their present positions, it will be necessary for you to arrange your plan with that in mind. We may be able to help you from this headquarters if we know in general your plans."

"I want," said Jones, "the front-line company commanders to leave in each of their forward combat groups and in such other combat groups as I designate a squad of riflemen and a light machine gun and gunner with

plenty of ammunition. That will be my *covering shell*, as it is called now."

"And a damn good name it is," interrupted the Colonel.

"Behind this covering shell I want my supports. Each support to consist of one or two sections of the rear company in each front-line battalion area. I shall also want these supports to remain in the combat groups which they are now occupying. These supports must be selected so as to be able to provide depth to the covering force along probable enemy approaches into the position and later to cover the withdrawal of the elements of the covering shell."

As the covering force commander was talking he was making vigorous pencil strokes on a piece of paper. Finally he picked up the paper and handed it to the Colonel.

"This," he said, "is the idea as applied to our situation." (See Figure 20.)

The Colonel glanced at the paper and replied, "You have it about right, Jones. You are one of those rare birds who can take a theoretical teaching and apply it to a concrete problem. This looks as if it would work. Well, tonight will tell the tale. Anything else you need before I release you to start your work?"

"One other thing," Jones said, just a little flustered at the Colonel's praise, "I will need a staff officer. I can't take any from my battalion for it will need everyone to help it to get out of the hole it is in. Can you lend me a staff officer?"

"Well," answered the Colonel, "since this is really my covering force, it is only fair that I let you have one. You may take S-1. If there are no more questions you can start your preparations for tonight."

The covering force commander moved to one side and explained in detail his plan to S-1.

"There," he said finally, "I believe that covers it. Now you go to the 2d Battalion CP and I will go to the 1st Battalion CP. I know my own battalion sector but I want to see the sector of the other front-line battalion. Between us we can settle with the front-line commanders all the

necessary details. If I have time later on I will drop in on the 2d Battalion CP, but that is problematical for I want to be back here when the Executive returns with his information of the new position. You be here, too.

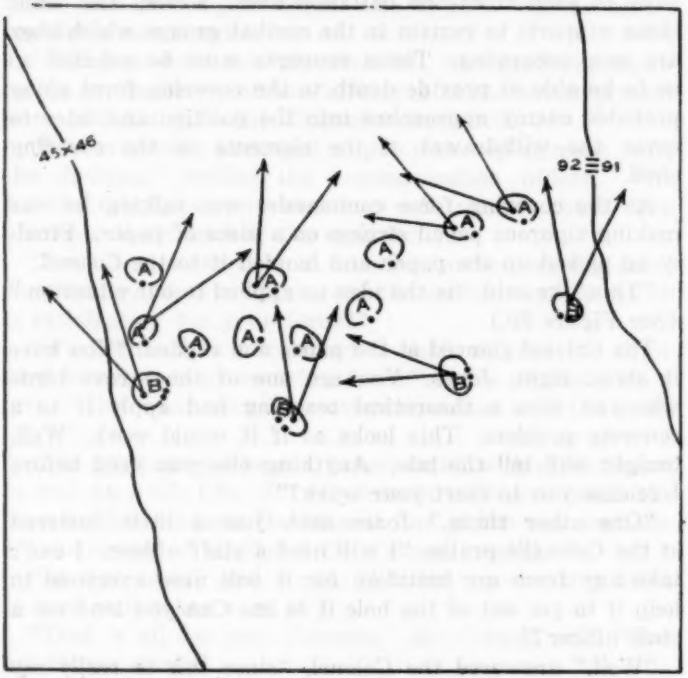

FIGURE 20.—Dispositions of the covering force.
"A" indicates elements of the covering shell.
"B" indicates the supports.

Remember that we are representing regimental headquarters for the time. Let's get going." Both left the Regimental CP.

S-3 walked over to the Colonel, who had discarded his

cigar stump and was biting off the tip of a new cigar.

"Any more orders, sir?"

"I am just turning over the situation in my mind to see if we have missed any point. I will let you know if anything occurs to me. Now comes the most important part of any order—it's the supervision. Check, check and —what was it that those old time comedians used to say? Oh yes—'double check' everything. Keep our headquarters on the jump if you have to, but don't under any circumstance annoy the troops. After all they are fighting. Don't put any more load on them than necessary. Put the load on the staff. Above all see that the covering force commander has the very latest information and make it your business to see that the staff gives it to him and that he does not have to dig it out himself. Get busy."

The Colonel turned to survey the sun which was slipping rapidly toward the horizon. He cocked his ear toward the front where the noise of firing was slacking off. He swung his eyes toward the staff which was performing smoothly and almost noiselessly. He sighed slightly, as one does who has finished a ticklish job, scratched a match, lit his cigar, settled more firmly in his seat and again turned his eyes toward the horizon. Yes, he thought, the set-up seemed all right; but tonight would tell the tale.

It was the next day. S-3 was writing furiously in his notebook when Brigade S-2 ducked into the command post.

"That was a sweet job you fellows pulled off last night," he said. "You 'slipped away like a thief in the night.' The other regiment got pretty badly mauled. Fact is they had to sacrifice a part of their covering force to get clear. Good man you had as covering force commander."

"That shows just how much you know of it," said S-3 scornfully. "Sure Jones is a good man, but that movement was planned to an eyelash by the man sitting so quietly chewing on a cigar." He pointed to the Colonel. "Jones wouldn't have had a Chinaman's chance if the Old Man hadn't coordinated every last item before he turned

the job over to the covering force. Come down here sometime and learn a little tactics. As for me I am busy now. I got to get some notes down before I forget them. Anyway I am always too busy to listen to a baby brass hat."

"My, how annoyed our Shrimp is," said the Brigade S-2 with a grin. "What is this that you are so busy on?"

He reached over a hand like a ham and plucked the notebook from S-3.

"Oh, Oh, so little Shrimp is studing to become an American Ney. The greatest rear guard commander of his era." He flipped a page. The amusement faded from his eyes.

"Boy, I'll take that back. This is good, let me read it through."

And this is what he read:

NOTES ON AN INFANTRY REGIMENT WITHDRAWAL

1. Think and plan ahead.
2. Decentralize control as rapidly as possible.
3. Upon receipt of a warning order:

a. Select the best man available as your covering force commander.

b. Get the ball rolling by warning unit commanders and the staff of what is coming.

c. Assemble rearward reconnaissance parties and initiate rearward reconnaissance for assembly areas, routes or withdrawal, and a new position if necessary.

d. Gather staff and unit representatives.

e. Check your actions for omissions.

4. Upon receipt of withdrawal order:

a. Get a crystal clear picture of what is wanted.

b. Make a plan of withdrawal and a tentative plan for the occupation of any new defensive position.

c. Send a representative to the rear empowered to act for you as regimental commander.

d. Coordinate with artillery.

e. Issue fragmentary orders from time to time so that unit commanders and staff may act on latest information.

f. Publish written order when time permits.

5. Give your covering force commander:

a. Communication.

b. Staff assistance.

c. Full cooperation.

6. Supervise, coordinate, check and double check.

CHAPTER 5

A Study of Leadership and the Moral Factors of War

(AN INFANTRY SCHOOL STUDY)

Sun the Master said:

"Wherefore the good fighter seeks victory from spirit, and does not depend entirely upon the skill of his men."

The Chinese Book of War,
5th Century B.C.

"It is the mind that wins battles, that will always win them, that always has won them throughout the world's history. The spirituality, the moral quality of war has not changed. Mechanics, modern arms, all the artillery, aircraft, and so forth invented by man and his science will not make an end to the thing so lightly considered at the moment and called the human soul."

Major General Ely,
Lecture Army War College.

Clausewitz said: "In war all things are simple, but the simple is difficult." Napoleon often remarked that the art of war was simple to understand; the difficulty was in applying it. In short the tactical or strategical scheme is simple—to succeed it must be so—but to carry the scheme through to the conclusion is difficult. Actually then, we have two parts to any military problem: one

the scheme itself—a simple conception based on many factors; the other, the execution of the scheme.

The evolution of the scheme is a purely mental and creative process, involving, as we shall see later, many intangibles; the execution of it is in the physical realm. This latter, to be sure, involves much mental work by the staff and others, dealing with the physical factors of time, space and logistics in order to get the troops to their appointed place on time and in condition. But mainly it involves a high degree of leadership. And when we deal with *leadership* we are entering the realm of *moral and spiritual values—the intangibles of battle.*

For example take the problem facing the 2d Division in the Soissons offensive. The tactical scheme was absurdly simple, but even to start executing it seemed an impossibility. To arrive at the jump-off position, a whole division had to move nine kilometers at night through the dense Foret de Retz with many side trails to lead units astray. Few maps were available. The forest was jammed with tanks, artillery, trucks, animals, and 67,000 men. To an officer on the ground, the task seemed impossible; and this was before a terrific storm broke which added to the gloom; and traffic congestion pushed the infantry into the gutters, broke the column, and forced all movement in single file, each man clinging to the man in front.

No amount of intellectual ability, no neat march table, no ratiocination could bring these troops to battle. It needed something else, and that was leadership. But such leadership was present. The attack went off on time and was a brilliant success. Suppose these officers were not leaders and the men were not imbued with faith in their leadership. How many soldiers would have arrived at the line of departure in the confusion and darkness?

Yes, Clausewitz is right: "The simple is difficult." And it would appear that this difficult part is in the realm of leadership—that mysterious field of moral and spiritual values. It would pay us to investigate this matter. But

we do little exploring. Our attitude is clearly defined by a quotation from a lecture of Major General E. L. King. He said: "No one can dispute the importance of the art of command, but by inaction we imply that it is a subject which we cannot teach, but also that it is a subject that cannot be taught—and so, to comfort ourselves, we say that a man is either a born leader or a born fool and that is the end of it."

Perhaps our efforts in this field, when made, have been comparatively fruitless because it is customary to study leadership by making a close analysis of the personal qualities of commanders who have been successful in battle. All are judged to be leaders because they have won battles—an unwarranted presumption for there is, as Napoleon said, a great element of luck in war. Moreover, differences in national morale, national organization; differences in military organization, differences in tactics and arms—all those and many other factors affect results. Given an advantage in all these factors and even a mediocre man lacking any leadership may produce victories. Pompey of Rome won so many victories that he was called "the Great." Then Caesar, a real leader, came along and snuffed him out as one would a candle. Therefore it would seem plain that success in battle, or a series of battles, is no sure criterion that a commander possesses either leadership or, for that matter, generalship. For instance, Rome dominated the world for half a millennium, but she did not produce a fistful of first class generals. The higher commanders were generally mediocrities and sometimes amateurs. Actually the victories of Rome were gained by the splendid leadership of the centurions—the ancient equivalent to our company and battalion commanders.

Since those old Roman days many commanders have won great victories, or avoided defeat, because of their leadership and not generalship. These commanders are often carried to victory on a foaming wave of enthusiasm; or clinging to a stricken field by the fighting fury of their troops, win, when according to the book they are

defeated. They have so "aroused, incited, and directed" their troops that victory is achieved despite faulty dispositions, lack of numbers or clever maneuvering by their opponents. Thomas at Chickamauga was such a man, and so was Blucher, Wellington's collaborator in the campaign of Waterloo. It would have gone hard with the Iron Duke if Blucher's leadership had not been great enough to bring the Prussians to the field of Waterloo, before it was too late.

When in history we find a man who has this leadership quality developed to a superlative degree, coupled with an astute tactical and strategical sense then, granted the proper historical stage setting, we have one of the great captains of history—Alexander, Hannibal, Caesar, or Napoleon. Over their campaigns we pore, with great industry, charting the move of the smallest unit, studying arms, armour, tactics, terrain, formations, strategical moves and what not.

If the leadership factor is ever thought of in such a study, it is dismissed with a wave of the hand, or it is taken for granted, or its value minimized. Yet here may lie the success of the great captains. Certainly here is our field of study. For all things change in war except man. There has been an evolution of civilization but no evolution of man during recorded history. As man acted at Zama, so he acts today and will act tomorrow, and the methods of handling him efficiently when Greek and Roman met at Cynoscephalae are the same methods that apply today or will apply at some future Armageddon. Mark this down: of all the factors of war, man alone is constant throughout history. Therefore though tactics change, leadership does not.

Yet we must step cautiously here for no leader can be considered and analyzed apart from his times. The florid speeches of Napoleon which aroused his men to wildest enthusiasm would probably evoke snickers from the ordinary American. Yet a slight change in the wording, a few trenchant, pungent phrases carrying the same ideas in the argot of the common folk of today would arouse the Ameri-

can soldier to the same heights. The Frenchmen of the French revolution thought in florid terms, the American less grandiloquently, but both at the bottom react the same to the same stimuli. That is our rock foundation.

However, before we can continue with this analysis of the interplay of leadership and the moral factors of war we must first decide just what a leader is. The dictionary says he is "one fitted by force of ideas, character, or genius, or by strength of will or administrative ability to arouse, incite, and direct men in conduct and achievement." Even here we run into difficulties. What exactly is meant by "force of ideas"? Can one explain "genius" in simple terms? Does "character" mean honesty, integrity, and the other qualities of a good burgher? If so, many, if not most, of Napoleon's Marshals could not qualify. For instance, Augereau the rake, the intriguing Bernadotte, and one-eyed Massena, who was not above diverting a few million francs from the public revenue into his own pocket, could not fit into that classification.

What distinguishes "strength of will" from plain stubbornness? "I purpose to fight it out on this line if it takes all summer," said Grant, after the bloody battle of the Wilderness. We can call that strength of will now, since he won the campaign, but if he had fallen into disaster later, history might have written him down as a simple, stubborn man. Where is the dividing line? It is to be feared that the criterion is often based on the success attending the operation. The commander is given credit for "force of will" when he succeeds and "stubbornness" when he fails. A most unscientific method of drawing conclusions.

Moreover, what exactly is "administrative ability"—that all inclusive word? It would seem to be not a unit quality but the resultant of many qualities, among which is leadership itself. Surely we cannot define leadership by using a term which in itself includes the quality of leadership.

So much for the qualities which distinguish a leader,

according to the dictionary; and it would seem to get us exactly nowhere.

Yet, after all, the definition does have something of great value. It says that a man is a leader if by reason of certain qualities he is able to "arouse, incite, and direct men in conduct and achievement." It would be a better definition to omit the qualities supposed to distinguish a leader, and say that a leader is "one who is able to arouse, incite, and direct men in conduct and achievement." Just what qualities in a leader's personality do "arouse, incite, and direct men" is better left for a thorough psychological study. This is beyond the scope of this article.

The above, however, is only a generality and gives but a fragment of the necessary equipment of a military leader. He must, in addition, have the ability to gauge the stage to which his men have been "aroused and excited," or if they have been stirred at all; for they may, perhaps, be at the nadir instead of the zenith of spiritual vigor. He should know it. He should know also how occurrences in the physical world affect or will affect the spiritual strength of men. And finally the military leader must have the moral courage to utilize these impalpable factors in deciding upon and carrying out his plan of battle.

This last is by no means easy. Often 5,000 men will more than equal 10,000. The real leader senses that and incorporates it in his plan. Yet most commanders, knowing this fact but faced with the cold figures, get cold feet, temporize and straddle. They will needlessly waste men before the weak 10,000 that might better be withdrawn to give weight to the main blow.

If we could have at headquarters a thermometer of sorts which could measure the elan and morale of our own force, and another which could do the same for the enemy force, the problem might be vastly simplified for the pseudo-leader. He could match thermometer figures against numerical strength, consult a conversion table that some bright lad had devised and come to a mechanical decision regarding the psychological factors. But as it

is, and as it probably always will be, the leader must be his own thermometer. In this field of spiritual values there is no one person, or thing, that can exactly determine the value of the spiritual feeling of large masses of men—except the leader himself. He must have the "feel of the troops."

It is a temptation too strong to be resisted to digress here and speak of the sensitiveness of all really great commanders. They must be sensitive in order to "sense" correctly the thoughts and emotions of the human mass under their hand. Napoleon of the Army of Italy had the sensitive face of an artist or composer of epic poems. The bust of Caesar with its great skull and the lightness and delicacy of the jaw gives the impression of a sensitive nature. "Combined in him in the highest degree," said one great historian, "were the realism of the man of action, the sensitiveness of the artist, and the imagination of the creative dreamer." One wonders how the sculptured face of Hannibal would look if divested of its martial beard. Alexander the Great was a keenly sensitive boy. It is not improbable that his demoniacal personal fighting in battle was but a psychological compensation—the indication of a shy boy trying to live up to a warrior ideal—his father Phillip.

Certainly the Big Four were not the iron-jawed insensitive type so often pictured as commanders. Each was like a wireless receiver so sensitive that it picked up signals too faint for ordinary commanders to preceive, or to translate. Care must be taken not to confuse the sensitiveness mentioned here with sentimentality. None of the Great Captains were sentimental. Caesar could massacre 50,000 people if he felt it would carry out his designs, and do it without compunction. The same is true of Hannibal, Alexander, or Napoleon. For coupled with this sensitiveness of mind each had a ruthless will that drove himself and his troops implacably forward to the objective. This combination of antithetical qualities is rare, and thus we have a rarity of great leaders.

But lest anyone think that this sensitive quality is

unknown among lesser lights, it is only necessary to mention Sherman, whom Liddell Hart dubs the first and only modern general. He was so sensitive that the criticism of the newspapers drove him into terrific rages and the story was printed that he was insane. It was Sherman who said that an army had a soul. To his receptive nature thus would appear the mass-mind of the command. The sensitive nature of Lee is dwelt upon by all his biographers. The same can be said for the flute-playing, dilettante philosopher, Frederick the Great, who shrank from the coarse military life of his time and was promptly flung into prison by his father. Or, stepping into modern times, we might mention Kitchener, a shy sensitive man, with a passion for collecting china, who hid his shyness under a grim exterior.

There seems to be little doubt that a leader must be sensitive to his command, no matter how insensitive he is to other things, for to sense or estimate the mass mental state of a unit, either a company or a corps, is most important—and most difficult. Only the real leader can do it. For instance: Prior to the battle of Chancellorsville after a whole winter of observation and inspections, all corps in the Army of the Potomac were rated for military efficiency. The XI Corps led all the rest. Yet at Chancellorsville the XI Corps fled precipitately, while units rated much lower fought coolly and bravely, and might have reached a favorable decision if the moral courage of General Hooker had been equal to his strategical skill. In short, the fact that the XI Corps was composed of immigrants, lacking the moral stimulus produced by the great national ideals which then permeated the North, was not given its true war value. The outward "spit and polish" of the XI Corps was given greater weight than the intangibles of the spirit. But when it came to the clash of battle it was these intangibles of the spirit that decided the issue—as they always do. But it takes a real leader to sense and give weight to such factors and always the pseudo-leader is led astray by surface polish.

It might be well at this place to twist the loose ends

together and endeavor to give a rough definition of a military leader, which, while it may not be as exact or as simple as some would wish, still will cover the ground. We can say that a military leader is one who has the ability to arouse, incite, and direct men in conduct and achievement, who can accurately gauge the mass feeling of his troops; who can judge the psychological effect of physical actions; and who has the moral courage to utilize these intangible factors in planning and carrying through his scheme of action. Note that a man may have all of these qualities and be no intellectual giant.

It should also be noted that this is a definition of a leader in terms of what he should be able to do. It is not an inventory of the qualities he must have in order to be a leader. This last is a subject often discussed and disputed and can only be settled scientifically by studying the character traits of a great number of men who fit the definition given above. This is too great to include in this study, except incidentally.

The definition as given might also do as well for a definition of "military character," and will serve to illuminate the statement in the new field service regulations of one great European power that "In war character outweighs intellect."

It is not the possession of any one of these qualities, even in the highest degree, that makes a military leader. Rather it is the blending of them all.

What happens, for instance, if the commander lacks any one of these qualities? If he cannot "arouse, incite, and direct" his men he will have a sluggish organization. The troops will never rise to he heights demanded in war. Such a unit is no match for a unit that is aroused. If he cannot gauge exactly the mass feeling of his men, he will call upon them for efforts beyond their powers, or, which is worse—and the unforgivable sin—not call upon them for that extra effort well within their ability which may mean victory. But above all things the leader must have the moral courage to utilize these intangibles of war in making up his plan for battle. If he lacks this courage

he becomes but a military doctrinaire, an orthodox, conventional commander whose actions follow the book and whose moves can be predicted with certainty by a keen opponent. There were many such commanders in the last war.

From all the foregoing, the vast extent and the wide ramification of the subject so glibly summed up under the single word "leadership" is clearly apparent. It is a subject just as wide as tactics and far more complex. To reach any suitable understanding of it, we must first break the subject down still further. This we shall endeavor to do.

Roughly, as indicated before, we may say that leadership comprises four distinct parts. First, the ability to arouse, incite, and direct men in conduct and achievement; second, the ability to gauge the psychological temper of a group; third, the ability to judge the psychological effect on the human mass of physical action; and fourth, the moral courage to utilize such findings in planning a tactical or strategical scheme. The first is the obvious part of leadership—to many the only part. Yet the man who possesses this alone is but a half-portion leader. The last part—the utilization of the spiritual qualities of a group as the basis of a plan—is far more important, and usually overlooked. Since this study is too short to cover the whole field we shall confine the remainder of it to a consideration of the neglected side of leadership—how commanders utilize or fail to utilize the spiritual qualities of their command in making decisions and plans.

With this in mind, let us briefly review a battle of our own Civil War. At Chattanooga Grant planned to drive the Confederates from the huge hill mass of Missionary Ridge. His scheme was for Sherman to make the main blow by getting astride the ridge on the north and attack along it enveloping the enemy right flank. Thomas in Chattanooga, facing the ridge, was to move out and make a holding attack against the steep escarpment by capturing the Confedarate works at the foot of the ridge. No attempt was to be made to scale the ridge from the front

and attack the heights. On the whole, the plan of attack was simple and appeared feasible. But when the battle started things began to happen.

Sherman seized a foothold astride the ridge and began his advance along it. He swept all in front of him until he came to a wide and deep ravine that separated the northern portion of the ridge from the main hill mass. To attack across it would be almost as difficult as to attack the ridge from the front. It was tried, however, and failed. Sherman was stopped with a jolt, and the terrain did not permit him to side-slip and get in rear of the ridge. The Confederate right was secure. With the stopping of the main blow, Grant's planned scheme of maneuver fell to pieces.

For the moment, however, let us turn to what is happening to the holding attack against the face of the ridge. The orders, as mentioned before, were to capture the Confederate works at the foot of the slope, but on no account to make the suicidal attempt to attack up the long, steep slope. In compliance with these orders the Union troops moved out briskly and with great dash captured the lower breastworks. Then, to the amazement of all, the troops failed to stop, but with increased momentum started a mad scramble up the rugged slope. Officers followed men pell-mell. Sheridan, commanding a division, poured himself a stiff drink of whiskey, cracked a joke and rushed to get into the front rank. Some wild spirit permeated these troops that astounded all. It was neck or nothing now.

Grant on Orchard Knob saw the whole scene spread out before him like a panorama. His staff was appalled. Grant bit savagely on his cigar and remarked explosively that somebody would pay for this. But no one did, for the Blue tide rolled up to and over the crest and the Confederates cracked and fled in a panic. Missionary Ridge was captured by a holding attack in disobedience of orders.

The histories give Grant credit for a victory; the military textbooks give him a cut for not knowing of, or giving

sufficient though to, the wide ravine that stopped Sherman's attack. Few appear to realize that Grant's great mistake was made in the field of spiritual values. He failed to gauge accurately the spiritual drive of his own force and the moral weakness of the enemy. Fortunately he won, but he might easily have lost if the Confederates on that day had had the moral drive of his troops and his troops had been as close to the verge of panic as the Confederates actually were.

Apparently Grant was a sound enough judge of spiritual values not to attempt an attack unless the spirit of the troops was high, but how high it was even he did not know accurately. If he had calculated these impalpable factors more precisely he would have secured a greater victory. If he had faith that his own men could capture the ridge by storm (which they could, and did) then Sherman after feinting at the Confederate right could have been swung well to the Confederate rear and Bragg's army might well have been captured. It might have been an American Jena. But to attempt such a hazardous maneuver he would have had to be accurate in his estimate of the moral value of his own and the enemy troops.

There is no implied criticism of Grant in this, for the generals who could judge moral and spiritual values accurately enough to try such a risky maneuver are few. They can be counted on the fingers of one hand and the count can start as far back as Thutmose III of Egypt. The illustration is given to show that ability to gauge moral values enters not only into the execution of a plan but also into its conception. The fact is that a maneuver or campaign becomes a classic one when it is built on these intangible factors.

This can be illustrated in Napoleon's first Italian campaign, which many think was his greatest. Scrutiny of this campaign shows that the secret of his success, generally speaking, was in maneuvering or using the terrain to separate the enemy force into two elements, and then using a small force to oppose one element while he massed and fell on the other. He banked on his small delaying

force securing for him the necessary time to make long marches, fight a battle against the first element, and return to face the second element ready for battle. It was no great feat to plot such a campaign. Anyone with a little imagination and daring could do it. To execute it was another thing. Furthermore, to know in advance that the troops would be able to bear the great psychological strain that must be thrust on them, is still another thing and a far more difficult one. It was the heart of the scheme of maneuver.

The scheme called for every ounce of effort that could be put out by everyone. It demanded lightning marches, and sharp, quick battle by the mass of maneuver, and stubborn fighting by the delaying force. The essence of the plan was to leave the very smallest possible delaying force in order to secure the largest possible force in the maneuvering mass. However, to leave too few men for delaying purposes would risk complete disaster. They might be swept aside quickly and the commander might find himself between two hostile forces and facing rout or capture. It took courage to pare the delaying force down; and it took consummate knowledge of the human heart and mind to know how low it could be reduced and still remain an effective force. At the same time it took the same sort of courage and knowledge to know the exact amount of extra effort that could be obtained from the maneuvering mass; for on this extra effort depended the success of the maneuver. After all both parts of the force were doing unheard of things for the times. Who could say if either part would find it humanly possible to carry out its mission? Nobody but Napoleon. And he knew it with such certainty that he based his battles and campaigns on it. The Army of Italy was Napoleon's greatest, as he often remarked—his greatest because of its moral stamina and the flaming patriotism that animated it. These moral qualities he often spoke about. These, too, he used with consummate skill.

The appreciation and utilization of the moral value of the troops was far more important in this campaign than

the scheme of maneuver, the terrain, or the size of the forces involved. It is in this field of moral values that Napoleon moved with so much sureness and in which are to be found the factors that underlie his success and his eventual fall.

The same psychological situation faces the modern commander (of a battalion or army) who thins out his front in order to obtain a mass of maneuver to strike the enemy flank. Every man possible should be in the main blow. Yet if too few are in the holding attack it means a half-hearted assault bringing little pressure on the enemy, because the men, realizing their weakness, will fail to attack vigorously. Yet tomorrow these same men in the same situation, impelled by an inward something, will undertake the attack with alacrity, and, few as they are, struggle desperately to push it home. Only the real leader can judge the fluctuating psychological temper in his troops; only the exceptional leader has faith enough in his own judgement of this temper to base plans on it.

But Napoleon was not the only one who could work such miracles. In this respect let us consider Stonewall Jackson. Jackson in his Valley campaign, which is another classic, secured his victories largely by the tremendous marching capacity of his troops. Anyone can plan to march troops great distances and thus secure victories; but to do it is another thing. The point to this is that Jackson planned with the expectation of using men in battle that by all the rules in the book should be worn paper-thin by marching and thus poor combat material. Yet he was so sure of the mental temper of his troops that he did offer battle, win, whirl away, march a prodigious distance, fight another battle and win again. It would look as if he took chances with his tired footsore men. One might say he gambled, except so invariably was he right that we are forced to believe that Jackson knew the psychological temper of his men so intimately that his actions were not chance-taking but based on clean-cut decisions in that all too vague field of psychological values. The one who hopes to emulate Jackson, will find

he needs not Jackson's logistical sense so much as his human insight—his knowledge of the mass-mind of his troops.

Or let us consider another great American, General Lee, in the campaign to which Jackson's Shenandoah campaign was but a prelude. In 1862 McClellan was in the Peninsula with the mass of the Union forces threatening Richmond, while other great Union armies were prepared to converge on Richmond. If McDowell at Fredericksburg reinforced McClellan, conditions would be hopeless. The Confederates were vastly outnumbered, as it was, and the situation looked, and was, indeed, desperate. General Johnston talked about evacuating Richmond, and President Davis ordered the archives packed for shipment.

In this situation General Johnston desired to concentrate the Confederate mass to meet the Union mass. (Note the orthodoxy of this conception—typical Western Front tactics.) Lee's idea was first to prevent the hostile concentration—witness how he planned to do it. Jackson in the Shenandoah Valley was *not* ordered to concentrate with the main army, but to attack the Union armies in his front. In an astute offensive campaign Jackson threw the Union armies back, thus creating a great fear in Washington for the safety of the capital. Would McDowell at Fredericksburg join McClellan or would Federal fear keep him to protect the capital? That was the psychological situation.

Now Lee had an intangible psychological factor to add to his strategical factors—the fear in the Federal Government. Would Lee have the moral courage to use it—remember he did not know what we know today; he was only able to estimate the effect he had created.

Actually, from the beginning, Lee had striven to secure this effect, believing that it would anchor parts of the Union force, particularly McDowell at Fredericksburg, and keep them out of the campaign in the Peninsula. This is how he used it.

Trusting that the psychological attitude of Washington would keep large portions of the Union army paralyzed,

and McDowell out of the campaign, he took his courage in both hands and called Jackson out of the Valley. McDowell stayed away and Lee thus faced McClellan with a united army. Although Lee was inferior in numbers in the whole Virginia theater, and even in the Richmond area, he went out to battle on ground of his own choosing with a superiority of two to one. As one commentator remarks, "Strategy could do no more."

But note this carefully: (1) Lee deliberately by his maneuvers created a moral condition in the enemy camp; (2) he gauged accurately the effect of these movements on the enemy moral condition and what this moral condition would do to the enemy forces; and (3) on these intangibles he came to a decision that enabled him to meet the enemy with a superiority of two to one. Remember there was no historian to tell Lee how successful his plan would be; he had to estimate that himself.

Lee's operation brings out the point that the commander who has the skill to analyze these intangible psychological factors of his own force correctly, has all the skill necessary to judge enemy psychological reactions. All he needs is the data; and G-2 should furnish him with a great amount of this. Hence, paradoxically enough, one trait of leadership which helps the commander in controlling his own force also helps him to understand how his operations will effect the enemy force.

The mechanistic interpreter of war who thinks he can, even at this late date, work out Lee's problem successfully without basing his plans on moral factors is welcome to his job.

Lee was in short a leader of the highest type. Lately some have raised questions about his strategical ability but no one can ever question his leadership ability.

As a matter of fact, almost any battle fought by a great soldier will show that in making his battle plan the leader leans heavily on the intangible factors that are too often neglected by the mechanistic interpreters of war. For instance let us pick at random the battle of Austerlitz. We might just as well select Cannae or any other battle

by a great captain. But Austerlitz will do nicely.

After the victory of Ulm, the sweep through Austria, and the capture of Vienna, Napoleon was faced by a combined Austro-Russian army. His position, despite his victories, was critical; for this army before him needed to be defeated, and that quickly and completely, before it was reinforced by two armies—one Russian and the other Austrian—which were coming up. Napoleon had under his hand at Brunn, near Austerlitz, but 50,000 men facing the Austro-Russian army of 90,000. His other corps were widely scattered with Davoust's corps at the greatest distance.

Davoust was some 70 miles away from the field of Austerlitz where Napoleon planned to fight—fight, not a cautious defensive battle on the heights of Pratzen, but a thundering, whirlwind of a battle that would completely destroy the enemy. Yet the French were 400 miles from their base, winter was at hand and the Prussians were ominously muttering and arming. The Prussian geographical position would permit them to cut the French communications easily, and English gold was tempting them to do just that. No wonder that Marshals Murat and Soult lost their nerve and counseled a retreat.

Napoleon seemed mildly interested in this recommendation, but stated that this was no "ordinary battle" he was planning but a decisive victory. And so the gallopers rode furiously with orders to the scattered corps. Napoleon's whole scheme depended on the timely concentration of his far-flung corps at Austerlitz before the enemy struck. Yet Bernadotte's corps was 50 miles away, and Davoust was some 70 miles away! It was hardly likely that the battle could be fought and won without Davoust, nor was it likely that Napoleon even considered such an eventuality. He picked his position and calmly ordered Bernadotte and Davoust to join by forced marches.

From Pressburg Davoust raced his corps toward Austerlitz, completing the march of 70 miles in 44 hours. He joined just in time for the battle. Then the corps found itself holding the right wing and fighting fiercely against

the enemy main effort. The troops after their grueling march had to stand up under hard pounding and the discouragement of being pushed back. However, they held stoutly until "the battle was ripe," when Napoleon with one lightning stroke broke the center of the enemy line and destroyed the entire Austro-Russian army. The tactical picture is fascinating; it so intrigues one's fancy that the human values which underlie it are forgotten or overlooked.

Davoust, to be sure, exhibited remarkable leadership in accomplishing his march and having a military unit that could stand up in battle instead of a footsore, straggling rabble. But the point is often missed that Napoleon was so sure of the temper of Davoust and his men that he firmly believed they could make such a superhuman march and still fight stoutly in battle. Accordingly he planned his battle—a battle which if lost would cost him his throne—on these intangibles. Anyone who thinks that Napoleon would have fought the battle whether Davoust came up or not, does not realize the Little Corporal's passion for concentrating for a fight. We may be sure that he was as certain that Davoust in fighting trim would be on hand for the battle, as he was certain of the number of corps in his army.

Anyone who can calmly plan a battle with a throne at stake in which he marches a corps 70 miles in 44 hours, and then subjects it to the full brunt of the enemy main attack, while coolly waiting the proper moment to strike, is either a madman, or else has a consummate knowledge of the moral values of war; and, furthermore, how to use this knowledge. Thus such a one steps from the field of tactics and strategy into the field of human psychology. It is with this psychological knowledge added to his military skill that he wins his battles. After all, any competent officer given the tactical picture of Austerlitz would know where and when to strike the finishing blow, but few would know how to produce such a tactical picture—and that is the important part—for to do that requires a keen knowledge of the human mind.

That day at Austerlitz, Napoleon showed he could gauge to a hair the capacity of his troops and thus he won a smashing victory. But there came a day when, surrounded by his Imperial entourage, he was insulated from his troops and thereby lost some of his skill in judging the mass human mind, and with it he lost his throne.

It is one of the odd facts of history that Napoleon's last great maneuver was exactly like his first one in Italy. History does repeat itself, but—as will be seen—never exactly. In the Waterloo campaign Napoleon pushed forward and succeeded in maneuvering between the English and their allies the Prussians. He separated them as he had succeeded in separating the Austrians and the Piedmontese in Italy. Then in the old familiar style Napoleon turned on the Prussians at Ligny, defeated them and drove them back and away from the English. Then leaving a containing force to hold the Prussians he turned to finish the English. Again we can see the old, but brilliant, pattern.

On the field of Waterloo he pounded the British until Wellington prayed for "night or Blucher." And Blucher did not fail him. He evaded the French containing force and late in the day came up, and Napoleon was caught between the two forces and defeated. Here the Italian maneuver failed. Why? The English will say because of the superb fighting quality of English troops; the supremacy of line formation over columns; the excellent dispositions of Wellington or his great generalship—though this last is mentioned less and less as years pass. They will give many other reasons in the same tenor. Marshall Wolseley attributes the loss of Waterloo to Napoleon's lethargy. Henry Houssaye of the French Academy said he never was more active and makes out a strong case. Von Schlieffen said that Napoleon should have followed up his victory at Ligny and finished with the Prussians before he turned on the English, he also believed the containing force that Napoleon left before the Prussians was *too large* and mentioned several other errors.

Everyone has a different story and everything seems

to have been considered except this one tremendous fact: At Waterloo Napoleon attempted a maneuver that was sound with the army of Italy to execute it but unsound with the army he had under his hand. This army, though good, lacked confidence in the generals and staffs; and comradeship and solidarity was lacking among the generals. The troops were full of ardor and confidence in themselves and Napoleon, but suspected treason everywhere, particularly among the generals and marshals.

This was not the army of Italy in spirit, and Napoleon's great error was that he did not realize fully that fact. He had lost his keen sensitiveness to the troops under him and did not gauge their moral qualities correctly. He leaned too heavily upon them—they broke; he crashed.

The list of errors compiled by Von Schlieffen and all others fade into insignificance before this great fact. Errors are always committed in war. Even the victors of Waterloo committed grave errors but won. The armies of Napoleon's early days could and did retrieve errors and pull their commander out of bad places by sheer tenacity and fighting power, based on spirit. For instance, at Marengo Napoleon committed the grave error of being caught by the Austrians while his force was dispersed; defeat meant complete disaster. The Austrians proceeded to trounce him soundly. All day he was mauled and manhandled; the troops took fearful punishment and were driven back steadily though they did not lose entirely their cohesion or break into a rout. Napoleon was beaten —no doubt of that—and a retreat was ordered. But in late afternoon Desaix after a forced march came up with a rush, the battle was resumed and night brought a complete French victory.

But there was no army of Italy or Desaix at Waterloo. The colossal error was that Napoleon acted as if there were.

In retrospect we can see the long way that Napoleon came from the clockwork movements of Frederick the Great. Gone was the famous oblique attack, the robot soldiers, and all the details of mechanistic battle. Napoleon

waged war with an unknown spiritual factor on his side. On this basis he evolved daring tactical conceptions of battle and with his new method proceeded to shake Europe to its foundations, topple thrones and make kings. It astounded the world and the drama of it still enthralls.

Jomini gives us, with dry preciseness, the geometric basis of Napoleon's tactical and strategical conceptions; but no one, even at this late date, has come forward to analyze and give us in clear form his method of gauging the human mass-mind; nor has anyone done the easier thing—shown us how much his tactical schemes were based on moral values. When he was crushed his methods were copied slavishly so far as they applied to the physical details of war, but the core of all—the evaluation and utilization of spiritual forces—was disregarded or remained unseen.

All we have said resolves itself into this: It takes leadership to evaluate the intangible human mass mind of the command, and the conclusions reached in this psychological realm can, and should, be used in planning a battle scheme. Furthermore, it is not too much to say that the more accurate a commander can estimate the human mass mind, and the more he utilizes this knowledge in planning, the more successful his campaigns and battles will be. Briefly, we should seek for the secret of war, not in geometric forms of battle, but in the minds of men.

CHAPTER 6

The Scope of Machine-gun Indirect Laying Technique

(AN INFANTRY SCHOOL TEACHING)

The reorganization of the infantry regiment, involving, among other things, the grouping of the supporting infantry weapons into a separate battalion, has emphasized anew the importance of machine-gun indirect laying. It is recognized that as the light machine-gun replaces the heavy machine-gun in the forward battle positions there will be an increased tendency to site the heavy guns in depth. The result will be that, in attack as well as defense, the heavy guns, or a portion of them, will be well back. Thus, if these guns are to fire at all during the early stages of combat, indirect laying must be employed. This fact is recognized abroad and the value of indirect laying is stressed in recently published training doctrines of several powers now feverishly engaged in reorganizing their armies.

Heretofore in our army there has been some tendency to consider indirect laying as a training frill, or of secondary value. In fact, so little emphasis has been placed upon this type of instruction that instances have been noted of machine-gun platoons competing for the Clark Trophy, using indirect laying methods rendered obsolete by at least two revisions of the text and occasionally even employing improvised technique.

This neglect of indirect laying training no doubt arose through the belief that the subject dealt only with the delivery of fire based upon complicated plotting and com-

puting. This belief is erroneous for the recent revision* in indirect laying has simplified even the long range problems which formerly called for the most complicated technique.

As a matter of fact, with the exception of the platoon leader and the range finder operator, a machine-gun platoon properly trained for direct laying is fully qualified to fire indirect laying problems. For this fact is sometimes forgotten: each time a machine-gun is placed in a direct laying position, indirect laying data must be obtained if the gun is to carry out its mission fully. Only with such data can the gun be fired accurately during periods when visibility is limited or lost because of smoke, dust, fog or darkness. Yet the training to do this is not difficult. It requires of the gun crew only the ability to lay off horizontal and vertical angles with the gun. What is often overlooked is that with this ability alone the gun crew can fire the most complicated problem in indirect laying. It is as simple as that. When it is also realized that this training in laying off horizontal and vertical angles is included in the most elementary phase of machine gun training—machine-gun drill—it is apparent that the failure to utilize indirect laying methods to the maximum can not be laid to the complexity of the training.

At the same time, some subjects though easy to teach and understand may require an elaborate installation in order to present the subject properly. This does not apply to the fundamentals of indirect laying, for a platoon can be fully and satisfactorily trained even indoors by using the caliber 0.22 gun. Moreover, indirect laying problems can actually be fired indoors at a range of 500 inches using a miniature range. This method of teaching indirect laying using the 0.22 caliber gun, to fire the actual problems, either indoors or on an ordinary rifle range, is fully explained in Chapter 7, Volume XII of the Mailing List.

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* See Special Text 8 Army Extension Courses.

The conclusion is inescapable that the duties of the gun crew in indirect laying can be easily taught, and if it is not routine to employ indirect laying we shall have to look further for the reason.

It has been stated that the platoon leader and the range finder operator are the only members of the platoon who need further training. What additional training will they need? Is it so complicated and abstruse that this alone prevents full utilization of this valuable technique? These questions can best be answered by studying the four types of indirect laying which may be employed. This will also serve to indicate the wide scope and flexibility of the technique.

TYPES OF INDIRECT LAYING

The platoon in action may be required to deliver fire based on indirect laying data under the following conditions:

1. From direct laying positions under condition of limited visibility due to night, dust, fog, or smoke.
2. From position defilade using a combination of direct and indirect methods.
3. From defiladed positions using data obtained from a single observation point (OP).
4. From defiladed positions using data obtained through use of more than one observation point (OP).

Let us consider each case in turn.

FIRE WHEN VISIBILITY IS LOST

Every platoon leader whose guns occupy direct laying positions is confronted with the fact that these guns must still be able to fire in defense of the position when visibility becomes too limited to permit direct laying. This is particularly important when we consider that, lacking stable mounts which permit fire to be laid on predetermined lines, the rifle, semi-automatic and automatic rifle and even the light machine-gun (in its present

form) become practically ineffective under such conditions. Thus the defense of the position during periods of limited visibility, so far as small arms fire is concerned, becomes primarily dependent upon machine gun fire, and this fire can only be delivered by indirect laying methods.

To apply indirect laying methods, requires of the platoon leader the analysis of his front and the determination of the critical areas upon which it may be necessary and possible to deliver fire. At this point the inexperienced platoon leader often goes astray, for the routine practice is to secure and record indirect laying data to all points shown on the day range card. It is forgotten that these points frequently have no significance when visibility is lost. Let us examine a standard range card and see why this is true (See Figure 21).

Upon the card, in addition to data required to fire upon the final protective line, is recorded indirect laying data to the four points shown (a tree, crossroads, house, and a small clump of trees). So long as visibility is good these accurately ranged landmarks are of value to facilitate range estimation in the event targets appear in proximity to them.

However, once visibility is lost, fixed fire upon such targets will hardly be of value unless the aiming point is exactly centered on a critical area of limited extent—for instance a bridge. To be sure it is desirable to deliver at all times grazing enfilade fire upon likely places such as routes of approach, edges of woods, or obstacles, natural or artificial. But to be able to do this in all cases is difficult if not impossible. In fact to secure one such place along which enfilade and grazing fire can be placed for a final protective line is often difficult. Therefore we shall frequently have to be content with less.

Since this is so the problem is to ascertain how within the sector of fire of the gun, fire of any kind can be delivered, and delivered with accuracy, even if visibility is low or completely lost. Since landmarks are valueless then, it is obvious we shall have to depend on quadrant

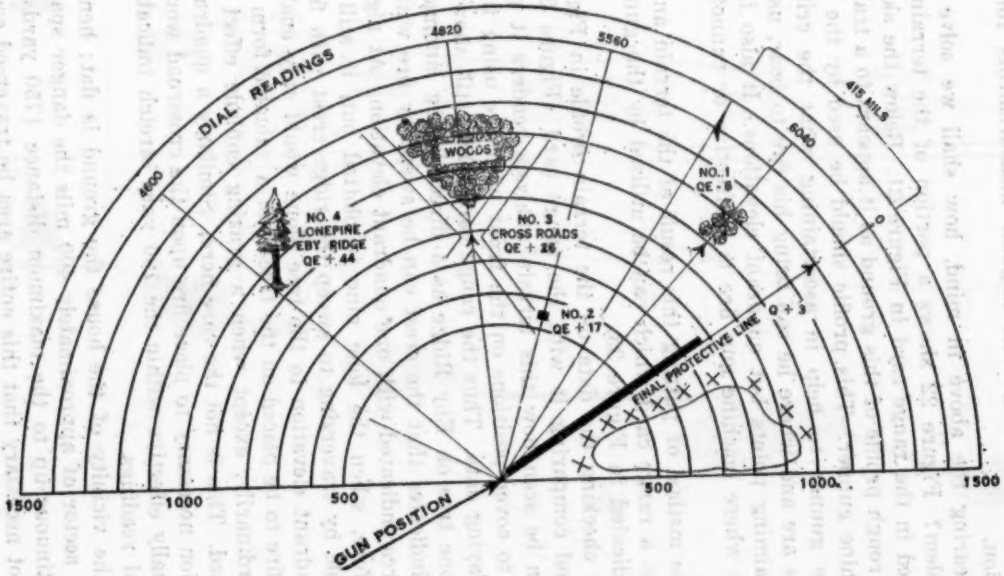


FIGURE 21.—Standard range card.

elevations for range and angular measurements for direction.

Bearing the above in mind, how shall we solve this problem? Figure 22 shows a portion of the terrain included in the range card in Figure 21. Below the sketch is a rough profile of this ground as it appears to a trained machine gunner. This profile should be used by the machine gunner to help in ascertaining what the critical areas are and where he can bring his fire to bear, using, not aiming points but quadrant elevations. It also indicates where machine gun fire is ineffective or cannot be used.

The method of putting this result of the terrain analysis on a range card which can be utilized by the gunner is indicated in Figure 23.

By checking the data on the terrain profile in Figure 22 and comparing it with the range card (Figure 23), it can be seen how this terrain analysis renders it possible to cover positions on the front with fire using indirect laying data. Thus the range card while still showing the lone tree on Eby Ridge as a direct laying landmark, now indicates that the crest can be swept by fire within the area indicated with one quadrant elevation. At night, therefore, when the lone pine is blotted out, it still is possible by traversing to sweep the ridge crest with fire. A quadrant elevation to the tree alone would only enable fixed fire to be placed on the tree—not a valuable form of fire ordinarily, except when a grazing enfilade effect is obtained. This is not the case here. Similarly a quadrant elevation necessary to place fire upon the crossroad would be equally effective within the 100 yard stretch indicated by dial readings.

In the vicinity of the house the ground is flat; hence over a sector of approximately 400 mils the danger space is continuous up to the maximum distance (750 yards). It is not necessary that this entire area be traversed each time fire is opened, the card merely records that anywhere within this area a quadrant elevation of + 6 will be effective. On the right of the sector of fire the small clump

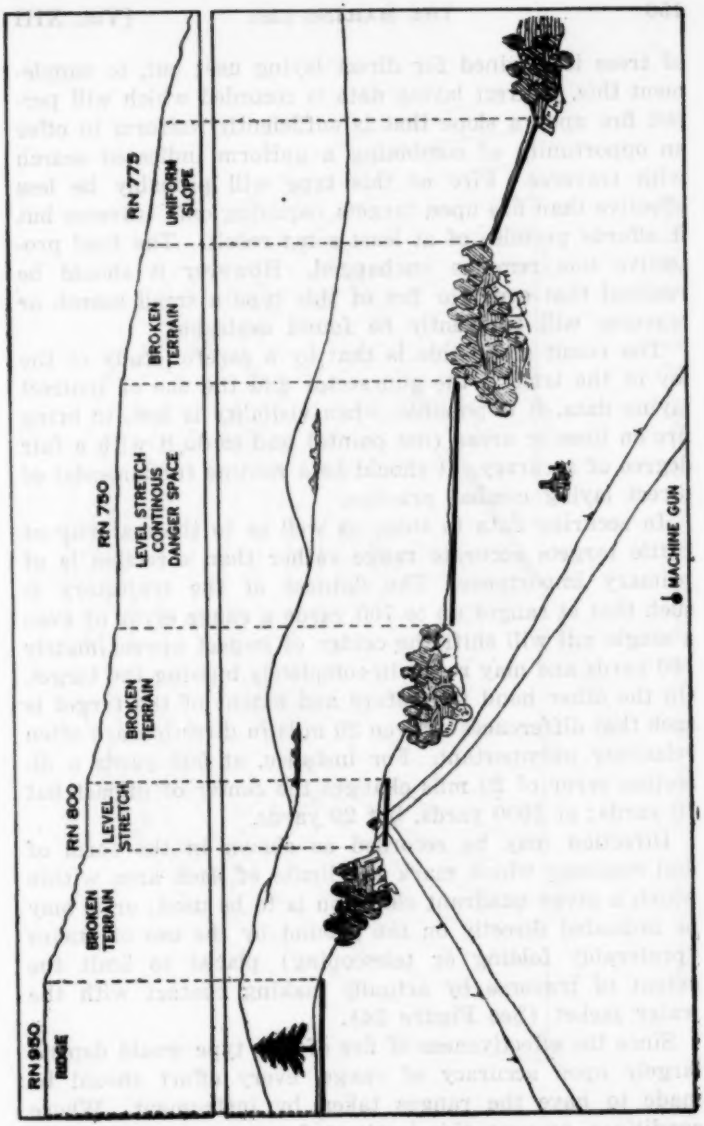


FIGURE 22.—Profile of terrain as it appears to a machine gunner.

of trees is retained for direct laying use; but, to supplement this, indirect laying data is recorded which will permit fire upon a slope that is sufficiently uniform to offer an opportunity of combining a uniform indicated search with traverse. Fire of this type will probably be less effective than fire upon targets requiring only traverse but it affords promise of at least some result. The final protective line remains unchanged. However it should be realized that even for fire of this type a small search or traverse will frequently be found desirable.

The result of all this is that by a careful study of the lay of the land in the gun sector and the use of indirect laying data, it is possible, when visibility is lost, to bring fire on lines or areas (not points) and to do it with a fair degree of accuracy. It should be a routine fundamental of direct laying combat practice.

In securing data to these as well as to the majority of battle targets accurate range rather than direction is of primary importance. The flatness of the trajectory is such that at ranges up to 700 yards a range error of even a single mil will shift the center of impact approximately 100 yards and may result in completely missing the target. On the other hand the nature and extent of the target is such that differences of even 20 mils in direction are often relatively unimportant. For instance, at 500 yards a direction error of 20 mils changes the center of impact but 10 yards; at 1000 yards, but 20 yards.

Direction may be recorded as shown in the form of dial readings which mark the limits of each area within which a given quadrant elevation is to be used; or it may be indicated directly on the ground by the use of stakes (preferably folding or telescoping) placed to limit the extent of traverse by actually making contact with the water jacket (See Figure 24).

Since the effectiveness of fire of this type would depend largely upon accuracy of range, every effort should be made to have the ranges taken by instrument. Where conditions prevent this, estimated ranges, used initially should be replaced later by those taken by instrument.

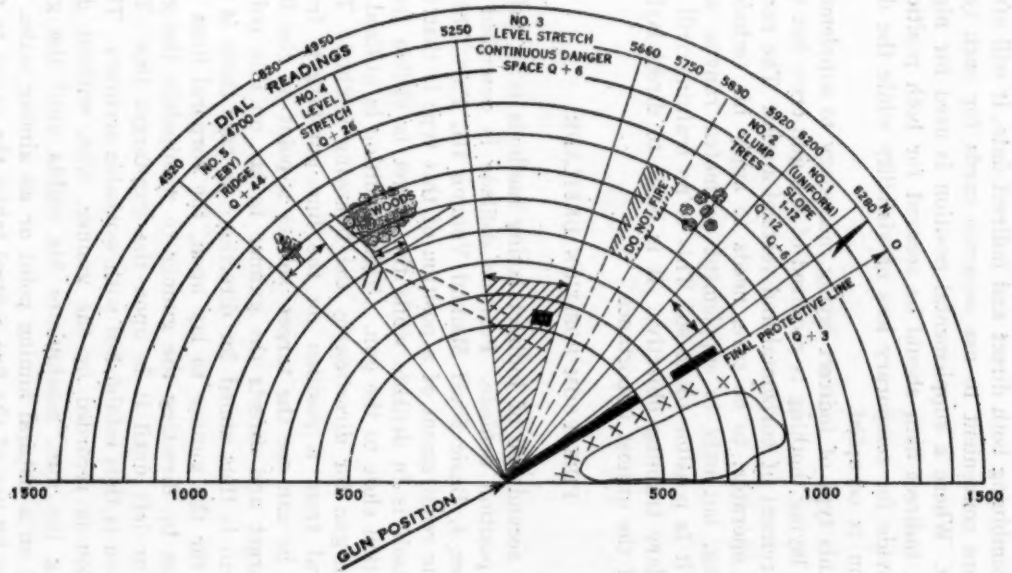


FIGURE 23.—Range card for firing during periods of low visibility.

Though in the example given a single range card is used combining both direct and indirect data, it will often be more convenient to use separate cards for each type of fire. Where a supplemental position is used for night firing, indirect data should be secured for both positions to provide for temporary loss of visibility while the day position is occupied.

In this type of indirect laying, necessary to supplement direct laying, nothing is required of the gun crew but the measurement of horizontal and vertical angles. The range finder operator, to be sure, needs to apply his technical training, but only to supplement estimated ranges, and when it is possible to do so. This is no training frill or secondary training objective. It is basic to direct laying and of the utmost importance.

FIRE FROM POSITION DEFILADE

The second use of indirect laying methods is in firing from position defilade. Position defilade is described in Chapter 4, Basic Field Manual Volume III, Part Three. A basic requirement of a position of this type is that the gun itself is in defilade while the target is visible from a position close to the gun. This condition is utilized to lay the gun for *direction* by the following method: The corporal from a position on the line gun-target, from which he can see the target, selects a point on the line gun-target and directs the gunner to lay on this point. The gun is thus aimed for direction. In case there is no point for the gunner to lay upon, the corporal lines up the gun by directing the gunner to manipulate the gun right or left until it is upon the gun-target line. The direction is thus established with workable accuracy. This direction is recorded by the gunner, who, without disturbing the gun, manipulates his sights until the gun is laid on a natural aiming point or an aiming stake.

Then by use of the fire control tables the range to the target is coverted into an angle of elevation. This angle is then modified by the angle of site, obtained either

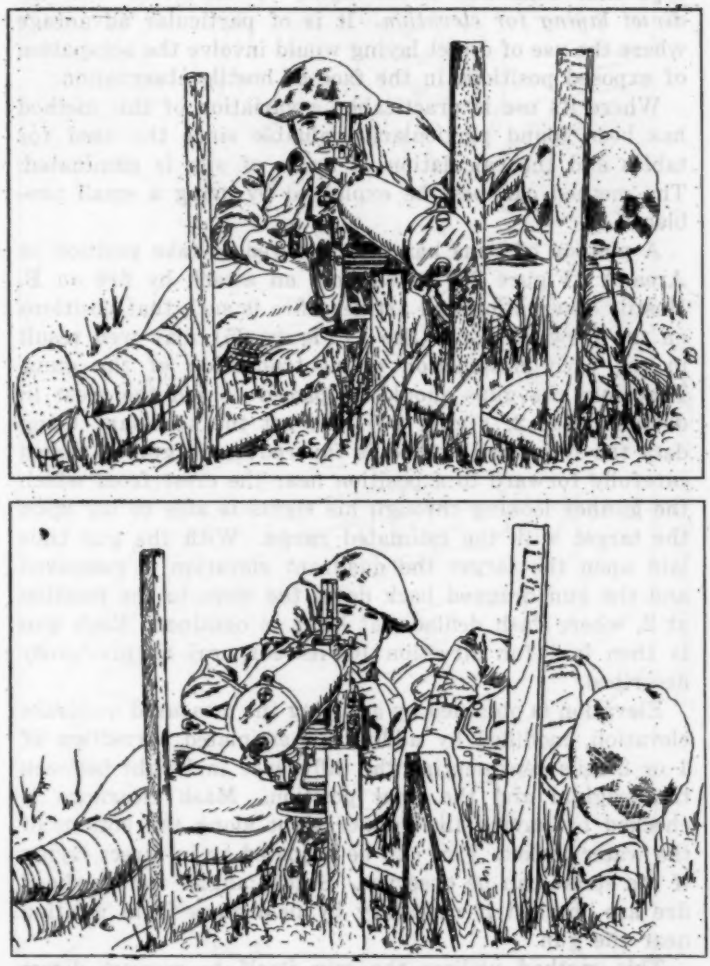


FIGURE 24.—Gun in position showing use of folding stakes.

through estimation or actual measurement. Fire of this type thus combines *direct laying for direction with indirect laying for elevation.* It is of particular advantage where the use of direct laying would involve the occupation of exposed positions in the face of hostile observation.

Where its use is practicable, a variation of this method has been found particularly valuable since the need for tables and the calculation of angle of site is eliminated. The method can best be explained by using a small problem.

A platoon of guns has been ordered to take position in Area A (Figure 25) to support an attack by fire on B. Hostile observation and artillery fire is such that positions on the forward slope (See 1, Figure 25) may well result in the early destruction or neutralization of the guns. Therefore the guns should be placed behind the crest in defilade (See 2, Figure 25). To get the necessary firing data the following method is favored: each gun is moved carefully forward to a position near the crest from which the gunner looking through his sights is able to lay upon the target with the estimated range. With the gun thus laid upon the target the quadrant elevation is measured and the gun dragged back down the slope to the position at 2, where flash defilade, at least, is obtained. Each gun is then laid for direction by its corporal as previously described.

Elevation is obtained by applying the measured quadrant elevation, modified by adding an estimated correction of 1 or 2 mils representing the difference in height between the original and the final position. Mask clearance is checked by having the gunner sight along the bottom of the water jacket. Fire can be adjusted as in direct laying if the strike can be observed. Safety angles for overhead fire are checked if necessary by field glass from position near the gun.

This method utilizes the gun itself to convert direct laying data into indirect laying data; yet requires no knowledge of the gun crew beyond that involved in the preparation of a range card. Here, as in the first instance,

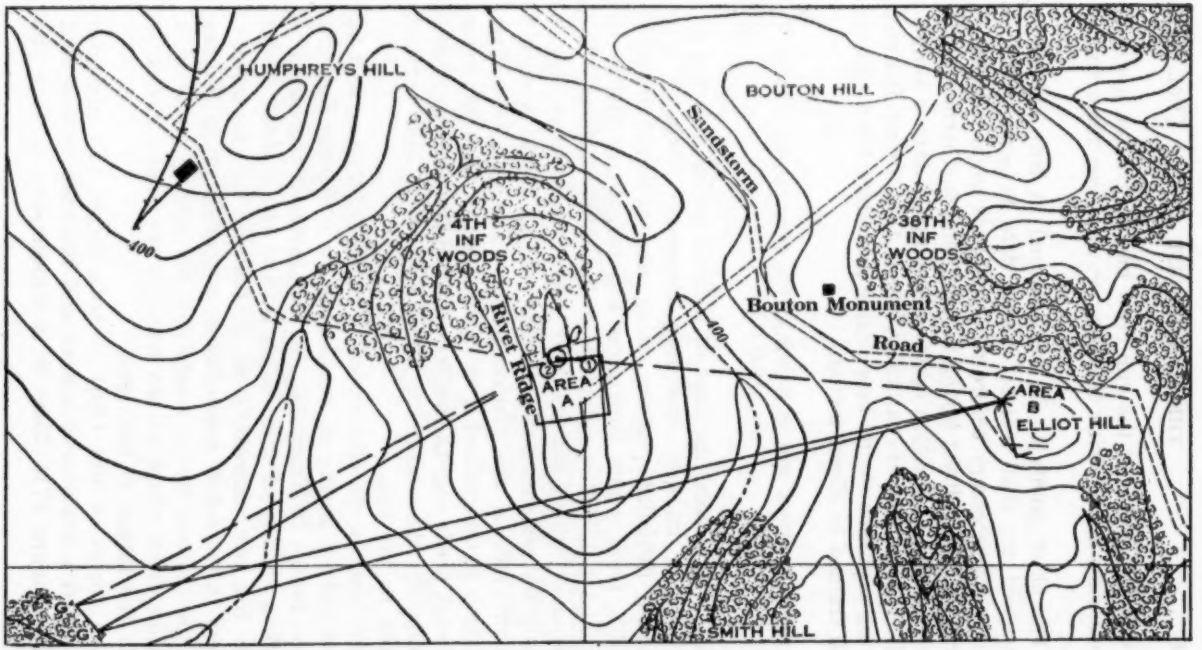


FIGURE 25.—Position defilade firing.

it will be noted that the gun crew has no greater job than measuring angles with the gun, or applying them to the gun.

The chief points to be remembered in both the cases discussed are that *indirect laying data* in some form or other was necessary before machine guns could completely carry out their direct laying mission, and furthermore that the training of the gun crew to accomplish this is simple.

It follows rather naturally, then, that firing indirect laying problems should be a simple procedure for a platoon well trained in direct laying.

FIRING GUNS FROM DEFILADED POSITIONS USING ONE O.P.

Up to this point the need of indirect laying data for direct laying missions has been discussed. Firing a gun from a defiladed position using one observation point (OP.), from which both guns and target are visible is, out and out, indirect laying in its simplest form. The discussion which follows may seem complicated but it should be remembered that this sort of work is within the province of the platoon leader. The gun crew does not have to understand it or know about it. The gun crew as usual, needs only the ability required for direct laying—specifically the ability to apply horizontal and vertical angles to the gun.

But what is the platoon leader's task? This can best be explained by means of an illustrative problem. For this let us return to Figure 25. In this instance the target is at B, a section of guns is at G, and the platoon leader with his instruments is at 2 (called "O" hereafter). Using instruments camouflaged as indicated in Figure 26, the platoon leader establishes his aiming circle in a position from which he can measure the angles clockwise from the target to each gun.

The angles of site (AS) to both target (T) and gun No. 1 (G^1) are also measured and recorded on the data sheet (Figure 27). Note it is unnecessary to take the

FIGURE 26.—Camouflaged instruments. Drawing made from actual photograph.

DATA

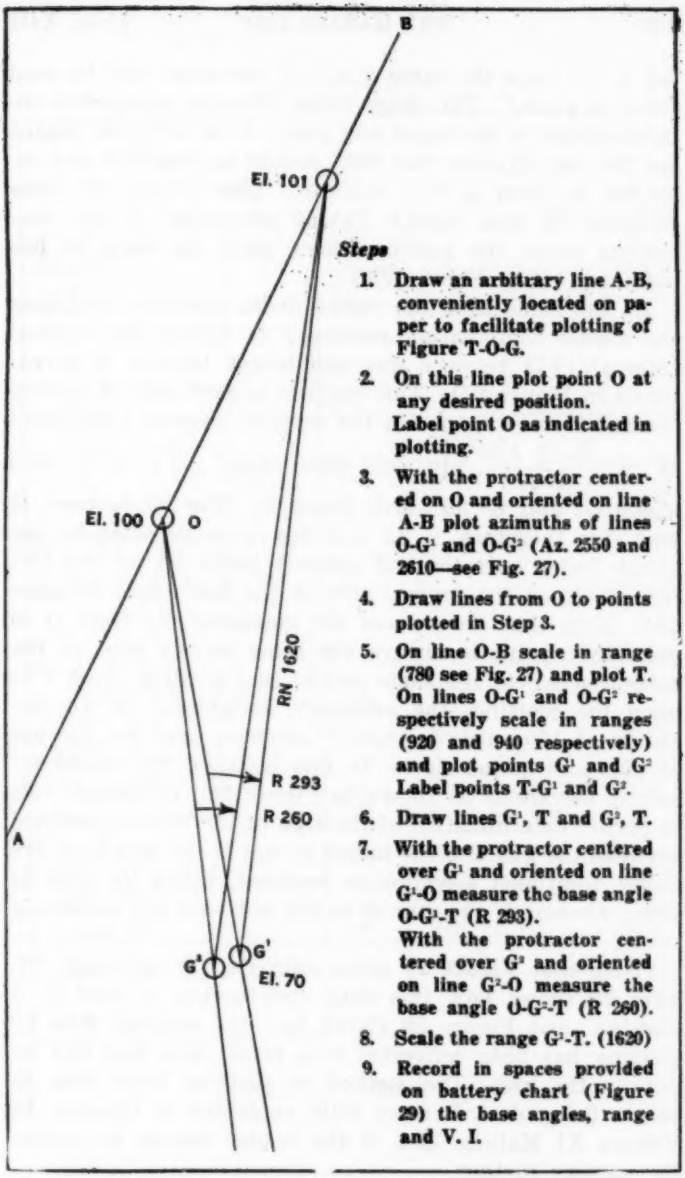
	O-T	O-G	O-G²			
Az.	0	2550	2610			
Rn.	780	920	940			
A.S.	+1	-33	—			
V.I.	(780= +1)	(2760 2760 30360= -30)				
Area and Plotted Point	*					
Rate						
Time						

Battery Front:	H-Hour:
Extending:	Map:

	G1	G4
Grid Azimuths of Base Lines		
Decl. Constant (Grid-Mag.)		
Magnetic Azimuths of Base Lines		

Date. .....

FIGURE 27.—Data sheet.



Steps

1. **Draw an arbitrary line A-B, conveniently located on paper to facilitate plotting of Figure T-O-G.**
2. **On this line plot point O at any desired position. Label point O as indicated in plotting.**
3. **With the protractor centered on O and oriented on line A-B plot azimuths of lines O-G¹ and O-G² (Az. 2550 and 2610—see Fig. 27).**
4. **Draw lines from O to points plotted in Step 3.**
5. **On line O-B scale in range (780 see Fig. 27) and plot T. On lines O-G¹ and O-G² respectively scale in ranges (920 and 940 respectively) and plot points G¹ and G² Label points T-G¹ and G².**
6. **Draw lines G¹, T and G², T.**
7. **With the protractor centered over G¹ and oriented on line G¹-O measure the base angle O-G¹-T (R 293). With the protractor centered over G² and oriented on line G²-O measure the base angle O-G²-T (R 260).**
8. **Scale the range G²-T. (1620)**
9. **Record in spaces provided on battery chart (Figure 29) the base angles, range and V. I.**

FIGURE 28.—Plotting from data in Figure 27.

AS to G^2 since the same quadrant elevation will be used for both guns.* The range finder operator meanwhile obtains ranges to the target and guns. Even with due regard for the use of cover this data should be obtained and recorded in from 2 to 3 minutes. (See Figure 27, data recorded on data sheet.) Taking advantage of any convenient cover the platoon leader plots the data he has obtained. (See Figure 28.)

At the same time the range finder operator completes the simple computation necessary to obtain the vertical interval (VI) between gun and target (shown in parenthesis in Figure 27). This consists in each case of solving the mil formula to obtain the vertical interval (W); thus $W = \frac{R \times AS}{1000}$. In this case target (T) is 1 yard above O; and G^1 30 yards below O. The VI between G and T is therefore + 31 and this is so reported by the range finder operator and entered under VI on the battery chart on the reverse side of the data sheet (Figure 29). Note that the sign of the computed VI from O to any other point is always the same as the sign of the measured AS to the same point. In recording these VI's upon the plotting, the arbitrary assignment of an elevation of 100 yards to point O obviates need for the use of plus and minus signs. In this instance this would result in elevations as shown in Figure 28. (A simple rule to permit determination of the sign of the vertical interval between the gun and the target is that if the gun is to fire *uphill* additional elevation is required, hence the sign is plus; whereas if the gun is to fire *downhill* the reverse is

*Note that Figure 27 gives data that is obtained; Figure 28 shows how this data step-by-step is used in a plotting; and Figure 29 shows how the original data by plotting has been converted into firing data that can be put on the gun. The method of plotting from data to obtain firing data is more fully explained in Chapter 14 Volume XI Mailing List, if the reader desires to pursue the subject further.

BATTERY CHART

			TASK			
G —Tgt.	G — Trps.	G — Mask		G —Tgt.	G — Trps.	G — Mask
1620			Rn.			
+31			V.I.			
			A.S.			
			A.E.			
51			Q.E.			

I.A.P. 0

Base Angles	Lay on I.A.P. Dial	Lay on I.A.P. Add	Gun No.	Angles of Shift	Lay on Base Lines Dial	Lay on Base Lines Add
R293	R280	13	1.			
R260	R260	—	2.			
			3.			
			4.			

BASE STAKES OUT		——STAKES OUT
Sight	FIRE ORDERS	Sight
Lay on Base Lines		Lay on Stakes
Boxes per Gun		Boxes per Gun
Quadrant		Quadrant
Trav. (R)		Trav. (R)
Search UP		Search UP
Rate		Rate
Time		Time

FIGURE 29.—Battery chart.

true.) The quadrant elevation is next determined by reference to the trajectory and safety chart (Figure 30 in pocket in end of book).

The procedure is as follows: in this instance the range G-T (gun-target) is 1620 yards and the VI is + 31. Using the range as an X and the vertical interval (VI) as a Y coordinate the intersection is plotted (Figure 30 in pocket at end of book).* The required quadrant elevation (Q) to hit the target is then determined by visual interpolation between the nearest black trajectory lines. In this instance the interpolated value is 51. This quadrant elevation is used by both guns.

Fire data must, of course, be transmitted to the guns. Any available means of communication may be used such as a written message, blinker light, or visual signal. Where a possibility of adjusting fire exists it is desirable for the platoon leader and his instrument detail to remain at the OP. Under such conditions a system of simple arm or flag fire control signals has been effectively used at The Infantry School.

The range finder operator and a runner constitute the signal detail at the OP; the platoon sergeant and another runner constitute the battery detail. By utilizing this set-up and using simple signals it is possible to deliver fire in 6 minutes from the time the first instrument reading is taken. Using the data of the preceding problem this method is illustrated step-by-step below.

1. Once the range finder operator completes computation of the vertical interval gun-target he signals IAP (Initial Aiming Point) and then indicates the point upon which the gunners are to lay, by establishing a flag at the aiming position.

2. When the guns have laid upon this flag, with zeroed dials the battery detail signals "Ready".

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* This chart should be saved by machine gunners and pasted on a piece of board the other side of which is to be used as a plotting board.

3. The instrument detail would then signal the direction data (in this case Right 293 followed by Right 260). The base angle for the right gun is always signalled first, followed by that of the left gun.*

4. As the guns lay off the base angles the battery detail as a check repeats the angles received.

5. The platoon leader meanwhile computes the required quadrant elevation as previously described, this being signalled as Q-5-1 (Q51). This signal is also repeated as a check as it is being applied to the guns.

6. The signal F (fire) is given at any time after receipt of the quadrant elevation is acknowledged. Where observation is possible fire is adjusted by using signals.

It should be realized that no attempt is made to hit a point, the effort being rather to place fire within a selected 100-yard target area. The point to which readings are taken (known as the plotted point) can be located anywhere within this square, preferably the center of the left edge. All guns traverse across the entire target, the required traverse being determined by a simple rule of thumb. This rule is to divide the range G-T into 100,000. Thus at 1,000 yards the traverse would be 100 mils, at 2,000 yards 50 mils, 3,000 yards—33 mils, etc. No search is normally required, the depth of the combined beaten zones of the guns being considered sufficient for most cases. However, in the event the target is unusually deep, a search can be applied, raising the Q in one lift through the angle required to shift the strike 100 yards at the range in question, then again traversing across the area.

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* Where more than 2 guns are used the procedure is identical with that described throughout except that readings are taken to the flank guns and the base angles signalled are for these guns. The intervals between guns being equal, the base angles of interior guns can then be determined at the battery by arithmetical interpolation, between the base angles of the flank guns.

INDIRECT LAYING EMPLOYING MORE THAN ONE O.P.

Since it is obviously an error not to employ available firepower, it will frequently be desirable to employ machine-gun fire from positions as deep as 2,000 yards within our lines. Under such conditions it will be rare that both gun and target areas are visible from a single OP. This will make necessary the use of several OP's or what is often called the *traverse method.*

The *traverse method* involves connecting the gun and the target areas by means of an instrument traverse. The aiming circle is used to obtain direction and angle of site; the range finder for distance. While this method involves employment of a more involved technique than those previously described, it has been found that the plotting of 10 or 12 problems will usually suffice to qualify the platoon leader to plot and compute such a problem with excellent results.

The procedure which follows is a slight variation of the prescribed technique. It has been found to afford a flexibility of employment of machine guns, which is important in rapidly moving situations, and it possesses the added advantage that platoon leaders are required to plot and compute at leisure, only a simple single OP problem of the type previously described. All other plotting is performed by the company reconnaissance officer.

To facilitate explanation an illustrative problem is employed, a tactical situation being built around a problem similar in type to problems fired at The Infantry School. Though this tactical background pictures offensive use, the delivery of defensive fire by guns echeloned in depth using the same method would, of course, be simple.

Our force is attacking to the southwest. (Figure 31 in pocket at end of book.) A rifle battalion, machine-gun company attached, is in a reserve position in the woods in the vicinity of (19.5-20.0).

The attack is known to be progressing, though the exact location of the forward elements is only approximately

known. In anticipation of sudden employment of the reserve it is desired to hold the guns close to the reserve battalion area. It is, however, decided to use these guns if targets can be located. The company commander therefore indicates to all platoon leaders and the reconnaissance officer a general area for the battery positions (Area A, Figure 31 in pocket at end of book). He also designates as the company control point, a lone pine on Davidson Hill (Figure 31). By a control point is meant a landmark used as a "tie-in" point, where instrument readings taken from the gun positions "tie-in" with those taken from forward OP's. It must be visible to the gunners. Where no natural landmark exists a flag may be stuck in the ground or a piece of cloth tied to a tree. The elevation above the ground of the point to be used must be indicated.

Platoons move individually to their battery positions under command of the platoon sergeants. Each platoon leader precedes the platoon with his rangefinder operator and a runner. Prior to the arrival of the platoon the flanks of the battery position are staked out and the necessary readings taken to tie this position to the control point. These consist of azimuth, range, and angle of site from the selected location of the base gun to the control point and the azimuth and extent in yards of the battery front, as shown for the second platoon in Figure 32.

As soon as the control point is designated and while platoons are moving to their positions the reconnaissance officer with his instrument detail moves toward the front. He moves by bounds from one selected position to another, keeping constantly tied in by instrument reading to the control point. Each position is marked before it is abandoned, to insure accurate identification from the next OP. In this instance, for example, the reconnaissance officer might first move to Point 1 (See Figure 31). There he could see that the control point could be seen from a more advanced OP, Point 2 (Smith Hill). He would therefore move forward to Point 2 without taking readings at Point 1. In close country several OP's might necessarily be occu-

pied before a point is reached from which data to suitable targets could be secured. This merely involves the plotting of additional legs on the traverse by which the reconnais-

Entered Later Upon Receipt of Data from Reconnaissance Officer.

DATA

	O'-A	O'-B				G'-O'
Az.	4025	3770				4150
Rn.	2665	2905				740
A.S.	E159	E157				+49
V.I.						6660 2960 +36260
Area and Plotted Point						
Rate						
Time						

Battery Front:	60 YDS.	H-Hour:	
Extending:	2165.	Map:	

	G1	G4
Grid Azimuths of Base Lines		
Decl. Constant (Grid-Mag.)		
Magnetic Azimuths of Base Lines		

Date. .....

FIGURE 32.—Data sheet of platoon leader. Certain data on this sheet entered later when received from reconnaissance officer.

sance officer is "plotted-in" to the control point. Under this system either guns or the reconnaissance detail can change position as required provided their position is re-

plotted from the control point. In the illustrative problem let us suppose that the reconnaissance officer finally secures and records data to two tasks (A and B, Figure 31). His data sheet and the resultant plotting are as

DATA

	O'-O'	O'-B	O'-A			
Az.	520	3850	4545			
Rn.	1800	1110	1080			
A.S.	+ 8	- 26	- 25			
V.I.	14.400 + 14	6660 2220 28860 - 28	5400 2160 27.000 - 27			
Area and Plotted Point						
Rate						
Time						

Battery Front:		H-Hour:	
Extending:		Map:	
		G1	G4
Grid Azimuths of Base Lines			
Decl. Constant (Grid-Mag.)			
Magnetic Azimuths of Base Lines			

Date. .....

FIGURE 33.—Data sheet of reconnaissance officer.

shown in Figures 33 and 34.

As a result of this plotting each task would be located *from* the control point by an azimuth, range, and elevation. This data in condensed form as shown below would be transmitted to the company by any available agency. In

this instance the message "TA-A 4025-R 2665-E 59" would indicate that Task A is located on a magnetic azimuth of

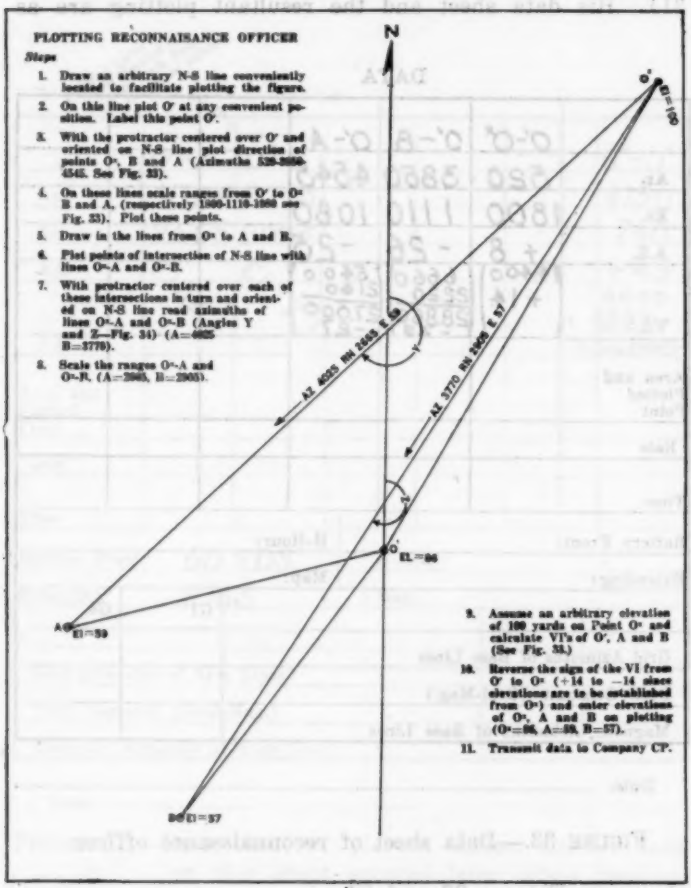
PLOTTING RECONNAISANCE OFFICER
Steps
1. Draw an arbitrary N-S line conveniently located to facilitate plotting the figure.
2. On this line plot O' at any convenient position. Label this point O'.
3. With the protractor centered over O' and oriented on N-S line plot direction of points O', B and A (Azimuths 520-2650-4545. See Fig. 33).
4. On these lines scale ranges from O' to O' B and A, (respectively 1000-1110-1980 see Fig. 33). Plot these points.
5. Draw in the lines from O' to A and B.
6. Plot points of intersection of N-S line with lines O'-A and O'-B.
7. With protractor centered over each of these intersections in turn and oriented on N-S line read azimuths of lines O'-A and O'-B (Angles Y and Z—Fig. 34) (A=4025 B=3770).
8. Scale the ranges O'-A and O'-B. (A=2665, B=2903).
9. Assume an arbitrary elevation of 100 yards on Point O' and calculate VI's of O', A and B (See Fig. 33.)
10. Reverse the sign of the VI from O' to O' (+14 to −14 since elevations are to be established from O') and enter elevations of O', A and B on plotting (O'=86, A=59, B=57).
11. Transmit data to Company CP.
N
O'
EL=100
AZ 4025 RN 2665 E 59
AZ 3770 RN 2903 E 57
Y
Z
O'
EL=86
A
EL=59
B
EL=57

FIGURE 34.—Plotting from data in Figure 33. (Plotting ½ actual size)

4025 and a range of 2665 yards from the control point. An arbitrary elevation of 100 yards is placed on the con-

trol point, thus the relative elevation of A is computed by the reconnaissance officer and sent as 59 yards.* Similarly data for Task B would read "TB-A 3770-R 2905-E 57".

Once received at the company CP these tasks would be allotted to platoons by the company commander. In this instance let us assume both tasks were allotted to all platoons. The plotting of the leader of the 2d Platoon is as shown in Figure 35. Prior to the arrival of data from the reconnaissance officer the plotting would have been completed to locate the battery from the control point (shown by dotted lines, Figure 35). Upon receipt of the data contained in the reconnaissance officer's message, the platoon plotting would be completed. (Solid lines Figure 35). For each task this would involve merely the completion of one O.P. problem similar to the one previously described.

While the guns are laying off the base and shift angles to place the base and task stakes, the platoon leader, using the ranges and VIs from G^1 to A and B, determines the quadrant elevation (Q) for each task as previously described for a one O.P. problem.

He is now in position to complete his fire orders as shown on the battery chart (Figure 36). The data to be placed on the sight will be determined at the moment of firing and for each gun will be the total of the corrections for zero, drift, and wind. Boxes per gun, rate and time will be as ordered by the company. Traverse is calculated as previously described and no search is to be used. The platoon is then ready to fire as ordered on either task.

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* The elevation of 100 yards is also placed on the control point in the platoon plotting, permitting computation of the battery elevation by the platoon leader as 64 yards. The elevations of A and B have been received as 57 and 59 yards respectively, hence it is merely a problem in mental arithmetic to compute the VI's to A and B as -5 and -7 respectively. This is entered on the proper line on the battery chart (Figure 36).

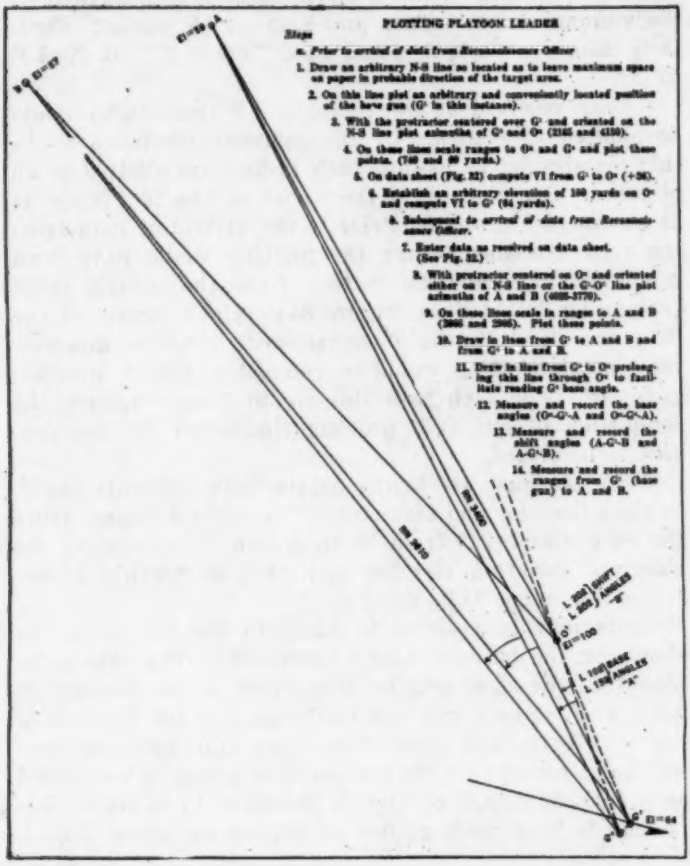
PLOTTING PLATOON LEADER
Steps
a. Prior to arrival of data from Reconnaissance Officer
1. Draw an arbitrary N-S line so located as to leave maximum space on paper in probable direction of the target area.
2. On this line plot an arbitrary and conveniently located position of the base gun (G¹ in this instance).
3. With the protractor centered over G¹ and oriented on the N-S line plot azimuths of G² and O² (2155 and 4150).
4. On these lines scale ranges to O² and G² and plot these points. (740 and 80 yards.)
5. On data sheet (Fig. 32) compute VI from G¹ to O² (+26).
6. Establish an arbitrary elevation of 100 yards on O² and compute VI to G² (94 yards).
b. Subsequent to arrival of data from Reconnaissance Officer.
7. Enter data as received on data sheet. (See Fig. 32.)
8. With protractor centered on O² and oriented either on a N-S line or the G²-O² line plot azimuths of A and B (6025-3770).
9. On these lines scale in ranges to A and B (2666 and 2905). Plot these points.
10. Draw in lines from G² to A and B and from G¹ to A and B.
11. Draw in line from G² to O² prolonging this line through O² to facilitate reading G² base angle.
12. Measure and record the base angles (O²-G²-A and O²-G²-A).
13. Measure and record the shift angles (A-G²-B and A-G²-B).
14. Measure and record the ranges from G² (base gun) to A and B.
N G¹ R=57
R=28 A
RR 3405
RR 3670
L 208 L 202 SHIFT ANGLES "S"
O² R=100
L 150 L 156 BASE ANGLES "X"
G² R=64
O²

FIGURE 35.—Plotting of platoon leader.

BATTERY CHART

A	*		TASK	B	*	
G' —Tgt.	G — Trps.	G — Mask		G —Tgt.	G — Trps.	G — Mask
3400			Rn.	3610		
-5			V.I.	-7		
			A.S.			
			A.E.			
147			Q.E.	167		

I.A.P. 0*

Base Angles	Lay on I.A.P. Dial	Add	Gun No.	Angles of Shift	Lay on Base Lines Dial	Add
L102	L100	2	1.	L202	L200	2
L121	L120	1	2.	L202	L200	2
L140	L140	—	3.	L202	L200	2
L159	L140	19	4.	L202	L200	2
BASE STAKES OUT				Red STAKES OUT		

	FIRE ORDERS	
Sight		Sight
Lay on Base Lines		Lay on Red Stakes
Boxes per Gun 4		Boxes per Gun 2
Quadrant 147		Quadrant 167
Trav. (R) 30		Trav. (R) 28
Search UP —		Search UP —
Rate Medium On Signal		Rate Rapid On Signal
Time H+2 TO H+10		Time H+0 TO H+2

FIGURE 36.—Battery chart.

From the foregoing the following seems plain:

1. Indirect laying involves no training beyond that required by direct laying so far as the platoon itslf is concerned.

2. In order to obtain maximum effect from machine-gun fire delivered under conditions of limited visibility, indirect laying data is essential.

3. Use of position defilade or of positions requiring the simpler type of indirect laying (one OP) permits delivery of supporting fires—particularly in attack—under conditions where the use of direct laying might well result in destruction of the guns.

4. The accuracy of all indirect fire is chiefly dependent upon the accuracy of the readings obtained with the aiming circle and range finder, particularly the latter.

From all this it can be seen that from a training viewpoint the technical requirements of indirect laying may be summarized about as follows:

1. The gun crew needs the ability to perform the prescribed movements of gun drill correctly. This is also a requirement for direct laying.

2. The platoon leader needs the ability to secure and plot data from which he can ascertain the correct angles to be applied to the gun.

3. The platoon leader and the range finder operator need the ability to use the aiming circle and the range finder, respectively. They must be able to use their instruments with facility and accuracy.

Most people will agree that the platoon leader should be able to figure data and that the platoon should be able to apply this simple data to the guns. However, some may have doubts about the feasibility of training men and officers to operate instruments with speed and accuracy, and do this within a short period of time. Yet this is not difficult.

At the Infantry School a course of two hours on each of the instruments is all that has been found necessary to qualify students in securing data which will permit the firing of problems up to 4000 yards. This short course is

sufficient to insure the understanding of the mechanism and develop the dexterity to operate the instruments slowly but accurately. To operate the instruments with speed as well as accuracy is, however, an essential of combat. Therefore to secure the dexterity that will permit this speed and accuracy the initial training period should be supplemented by a short daily practice session of 10 or 15 minutes for a period of approximately two weeks. This training problem, as can be seen, is not a great one.

To simplify the problem further for the commanders in the field, a later issue of the Mailing List will give a detailed and progressive program for training in instrument work which will fit the instrument operators to work with accuracy and speed.

CHAPTER 7

Staff Personality

(INFANTRY SCHOOL STUDY)

A smooth running and proficient staff is one of the most valuable auxiliaries available to a successful commander. And by the same token, Job himself suffered no more than does the commander who finds himself burdened with the discordant staff member who has become overawed with his own importance or bitten with the bug of pernicious activity.

The latter malady is an affliction which attacks officers who have lost their perspective and who have forgotten that they were selected to do work that the commander could, but hasn't the time to do for himself. So impressed do these officers become with the importance of their own activities that they begin to visualize themselves as the power behind the throne, with the commander set up as a mere figurehead for their benefit.

The story still persists that not so long ago a certain major general called his lieutenant aide, into the office and exploded, "Look here ——, we had better decide right now who is commanding this Corps Area, you or I." As no change was made in corps commanders, it is to be presumed that the lieutenant saw the error of his ways. Had he analyzed the attitude of his contemporaries the aide could have discerned his transgressions long before the general called attention to them.

A commander is irritated, to be sure, at having his authority usurped by some staff officer, but not half as irritated as are the subordinate commanders who deal with this staff officer. Troop leaders know from whom

they are entitled to receive orders and they vehemently resent any substitutions.

Basic decisions are not made by members of a commander's staff. The staff job is to study directives, orders, or tactical situations and anticipate future needs for action. Staff officers get from one another, and elsewhere, all available data required in preparing their tentative plan or plans. Their schemes are presented to the executive in the form of oral or written recommendations. The executive secures and announces the commanding officer's decision. The approved plan is then put into action and the staff checks to see that the orders of the commander are carried out.

That is the normal procedure. But any routine will be disrupted by a fast moving tactical situation. Members of the staff may become separated from one another and from the commander. Plans must be evolved and decisions made quickly, on the spot, and without reference to others. To permit formal procedure to delay operations would be stupid. Common sense must govern all staff routine.

Any commissioned officer can, with study, master the mechanical performance of a staff job, but the application of an officer's personality to the performance of any such duties is the standard by which his value to the unit is gauged.

Great latitude is allowed a staff officer in representing the commanding officer. Therefore, he must guard against abusing this power and be careful not to usurp any authority which has not been given him.

For example, in transmitting orders of the commanding officer a staff officer should use the expression, "The General directs—", "The Colonel orders—", or similar phrase. This is done even when the staff officer considers circumstances are so urgent as to warrant giving orders in the name of the commanding officer without that officer's previous approval. Having assumed such a responsibility, the staff officer must, at the first opportunity, advise the commanding officer of the action taken.

On the other hand, should a staff officer acquire the

habit of saying, "I want this," or even, "We want that—," his value to the commanding officer has become negligible. He will have also become an upstart and a nuisance in the eyes of the very people it is his duty to serve.

The staff can and should be of considerable help to the troops. It might be stated that members of the staff can also, through lack of tact and common sense, be just the opposite. For example, it is true that it is a staff function to follow up orders and see that they are being complied with, but the staff officer should not visit troops for the sole purpose of detecting errors and deficiencies. He should set out with the initial and basic intention of being of assistance to the troops in every way possible. He should be prepared to listen to grievances and be ready to intercede at headquarters on behalf of the troops. If this attitude is genuine, the staff officer will be accepted as a friend by the commanders of subordinate units and not looked upon as an intruder, or informer.

The staff may offer informal suggestions of a corrective nature, but official censure must come from the commanding officer.

Subordinate commanders of the unit and commanders of attached units normally deal with the commander through the staff. They receive from the staff most of the commander's orders and instructions. They discuss their difficulties and the many details incident to the carrying out of the policies, plans, and orders of the unit commander. In most cases these officers are senior in rank to members of the staff and this is an important point to be remembered. The staff officer should accord all officers the courtesy and consideration due their rank, even while disagreeing with their ideas, or correcting their mistakes.

At the same time, the most junior officer of the unit may expect to receive the same courtesy, and have his complaint or request listened to attentively. After all, he will generally need more help than the more experienced senior officers. The attitude of the staff officer should be such that the junior officer feels that the staff officer is there to lend him a hand over difficult places, and he will

come for that help. A brusque attitude toward these juniors will result in an avoidance of headquarters and the growth of misunderstandings. Thus deficiencies which might be avoided by friendly counsel will be discovered only by a formal inspection—perhaps by a higher echelon.

The staff may deal informally with the staff of a subordinate unit, but the former has no authority over the latter. Orders must be addressed from one commander to another and never from a staff officer in one command to a staff officer in another.

The average staff officer, as such, has no troops of his own to command. Moreover, he has no business "chiseling in" on the command of others. A staff officer who feels that he can lead troops better than the officers who are actually doing so had better curb this inclination or else request relief from his staff duties. He must remember that the units with which he deals are seldom those which his rank entitles him to command.

Through constant association at the headquarters, the staff member becomes familiar with the plans and policies of the commanding officer. He learns what the commander intends to do and just how he intends doing it. Without pretentions to being a man of mystery, the staff officer should refrain from divulging any part of these plans until they are released officially. Nothing is more disconcerting to a commander than to discover that a leak exists in his headquarters.

Along these lines an amusing incident might be taken from the World War, when, during the early days of September, 1918, every effort was being made to cloak with secrecy the concentration of an American army on the St. Mihiel salient.

An officer, en route from a hospital to rejoin his organization, became stranded in Paris. American officials were so secretive that the officer could not even learn which train he should take to start on his journey. Quite disgruntled, he betook himself to a cafe where he told his troubles to a French girl waiting on the tables. She told him to wait a few minutes while she ran across the street

to see a Frenchman who dispatched trains. She returned and told the officer he should go to such-and-such a town walk east for two kilometers, turn to the left into some woods and there he would find his organization hidden.

The officer went to the town as directed, walked two kilometers east, then left, into the woods—and there was the headquarters of the battalion to which he belonged. Furthermore, he was the only person in that whole battalion who knew where they were.

The secrecy of a commander's plan depends upon the discretion of his most loquacious staff officer. Yet, while silence may be essential prior to the announcement of a decision, the promulgation once begun must be thorough and complete.

The mere publication of the commander's decision in directives, orders, or memoranda, does not complete the transaction, as so many inexperienced staff officers seem to think. It is their duty to follow up and see that the troop commanders understand exactly what they are to do and to lend them help when possible. While following up these orders, the staff officer determines what mental and physical effect the commander's plans and policies have upon the troops. This enables him to recommend changes, or the formulation of new plans and future policies.

A good staff officer makes recommendations for a change in policy whenever he thinks it is necessary and does not permit himself to be relegated to the role of a "yes man."

Within the staff itself there must be complete loyalty and cooperation. Teamwork is the essence of staff duty. Further than that, each member of the staff must be capable of assisting or replacing any other staff member. One staff officer must frequently act for, and in the absence of, another. This sharing of duties does not, however, shift any of the responsibilities. A staff officer is accountable for any task assigned his section, regardless of who does the work.

If a staff officer permits himself, or any other, to evade results, pass the buck, exploit the troops for personal reasons, or cover staff mistakes by requiring the troops to do

added work (this is not uncommon) the command will be torn by internal strife. Anything accomplished will be in spite of, and not because of, the staff. Such staff officers are millstones around the commander's neck.

When mistakes are made, and all humans make mistakes, the error should be admitted frankly by the responsible person. The preparation of alibis and evasions is a waste of time that should be spent better in taking measures to correct the mistake.

The responsibilities of staff sections are clearly and definitely set forth in the War Department Staff Officers' Field Manual, Part One. The assignment of tasks to each staff section is based upon the accumulated experience of many capable officers, after years of work and study. When a better division of work is devised and adopted it will be initiated by the War Department and not by any embryo staff officer of a junior unit. Therefore, any attempt by one staff officer to increase the importance of his own section by encroaching on the responsibilities of another, will only arouse resentment and result in a duplication of work.

Properly organized, there is ample work for all members of a staff. When a staff officer goes searching for tasks that are not within his province, it is an indication that he does not recognize the scope of his own work, and, further, indicates that the work of his own section is being neglected.

In addition to his own special job, it goes without saying, that a staff officer must have a thorough knowledge of the tactics and technique of all infantry weapons. He must also be familiar with the capabilities, limitations, and tactics of the weapons and arms which may be attached to, or assist, or support, his unit. Poor judgment in the employment of auxiliary weapons is always costly. Cases are on record during the World War where ignorance or lack of judgment of the characteristics of auxiliary weapons led to their employment in a manner which inflicted serious casualties on friendly troops.

In combat, then, not only must the staff officer under-

stand the technique of weapons, but he must be thoroughly familiar with the conditions under which they are being used. This knowledge can be obtained only through personal visits to the locations of subordinate units. First hand knowledge of such factors cannot be obtained when sitting in the sanctuary of a command post.

By personal visits to the troops; by loyalty to the commander, fellow staff officers, and the troops; through courtesy and consideration of others—by all of these an officer may acquire the personality necessary to success—his success, his commander's success, and the success of the organization.

Personality cannot be drawn on memorandum receipt. It is the outward reflection of a man's soul. Nevertheless, by adherence to certain principles a man may appear to be even that which he is not. And by a strict and constant surveillance of his own conduct he may eventually overcome natural tendencies of a pernicious nature; thus becoming in fact what he would like to be—to-wit, a man admired and trusted by both high and low.

Some few are born with this quality, some acquire it through much self-discipline, while many never attain the heights.

Staff personality can be acquired, but only by those who know the true answer to this question:

Am I working for others, or am I working for myself?

CHAPTER 8

Limitations of Tanks

(From an antitank viewpoint)

(INFANTRY SCHOOL STUDY)

The improvement and multiplication of ground and air fighting machines during the past decade has accentuated the importance of antitank and antiaircraft measures in all armies. Previous volumes of The Infantry School Mailing List have contained several studies on infantry defense against air attacks, and in Volume VIII (1934), practical ideas on antitank defense were given for front-line infantrymen. This chapter considers tank weaknesses and limitations in order to arrive at a sound basis for building an effective antitank defense.

Our present means for defense against tanks and the methods of using these means are outlined in Chapter 9 of this volume.

In Chapter 10 the whole subject will be amplified by a brief examination of the methods practiced in European armies, where antitank defense is studied far more assiduously than it is in this country

The lurid possibilities of mechanized attacks against troop or supply columns, bivouacs, and rear area installations require no reiteration here. Volumes have already been written on this subject, and the foretaste given during the last two years of the World War makes us realize only too well that defensive measures against mechanized attacks must be seriously considered.

The merits of mechanization are beyond debate, though the scope of mechanization can still be debated. We have

arrived at the stage where there can be no denying that tanks, armored cars, and motors must be included among the primary implements of war. Moreover, armies are being rapidly mechanized and motorized, so whether we accede to the claims of tank enthusiasts or not, combat vehicles must be accepted as a *fait accompli* to be reckoned with in preparations for war.

If we are to fight against mechanized vehicles we must know their capabilities and limitations. For this reason it is advisable to analyze their powers and limitations. This involves studying their attack methods, their vulnerable points and the circumstances that favor or handicap their operations. In other words, we want to know the weaknesses of these mechanical tools of war so that in defense we can exploit these weaknesses.*

Mechanized vehicles mean armored fighting vehicles, or, broadly speaking, tanks (combat cars in mechanized cavalry) and armored cars. By tanks we mean armed and armored cross-country vehicles (usually track-laying). By armored cars we mean armed and armored wheeled vehicles that are able to move across country only on hard, level ground, and therefore usually operate on roads.

ANALYSIS OF COMBAT VEHICLES FROM THE VIEWPOINT OF THEIR VULNERABILITY

Table I is a rough classification of the combat vehicles now found in leading armies. These or their improved progeny will be seen on future battlefields. Column 4 of this table shows the maximum speed attainable and Column 5 the average combat speed. This last, more often than not, will be even less than that shown. The final column indicates the maximum armor thickness. This

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* The principal characteristics of foreign tanks are tabulated in Chapter 5, Volume VII, of The Infantry School Mailing List. A discussion of tank employment in the principal foreign armies is given in Chapter 6, Volume XII, of the Mailing List.

MAILING LIST——7

TABLE I

AVERAGE CHARACTERISTICS OF COMBAT VEHICLES IN CURRENT USE

Type	Weight (tons)	Crew	Max. speed (mph.)	Combat speed	Traction	Armament	Armor (in.) (max.)
Creeper	0.25-0.50	1	6-12	1-5	wheel ? track	1-L MG or 1-MG	.25-.50 front only (?)
Ultra Light (Tankette)	2-4	2	20-35	8-15	track	1-MG (or 1 cannon or 1 mortar)	.25-.63
Light	5-9	2-4	15-45	10-20	track	1-3 MG or 1 cannon and 0-2 MG	.35-1.33
Medium	10-20	4-6	15-35	8-20	track	1-2 cannons 1-3 MG	.59-1.4
Amphibious	3.3-11.0	2-3	6-10 W 25-38 G	8-20	prop. and track	1-3 guns	.35-.59
Obsolete light	7-8	2	4-8	1-4	track	1 cannon or 1 MG	.50-.87
Half-track armored car	4-8	3-4	25-30 F 15-20 R	10-15	wheels in front; track in rear	1 cannon and 1-3 MG	.25-.50
Light armored car	4-8	3-4	35-60	25-40 on roads	4 or 6 wheel 2 or 4 wheel drive	1 cannon or 1-H MG and 2-3 L MG	.20-.35

NOTE.—W = in water, G = on ground, F = forward, R = reverse.

means, of course, that only the most vulnerable parts carry armor of the thickness shown. The top, bottom, and other little-exposed surfaces have much less. Although there are exceptions, we can assume for this study that ⅜ inch is the heaviest armor on tankettes, ½ inch on armored cars, 1 inch on light tanks, and 1½ inches on medium tanks. These maximums are above what is found on the majority of armored fighting vehicles to-day.

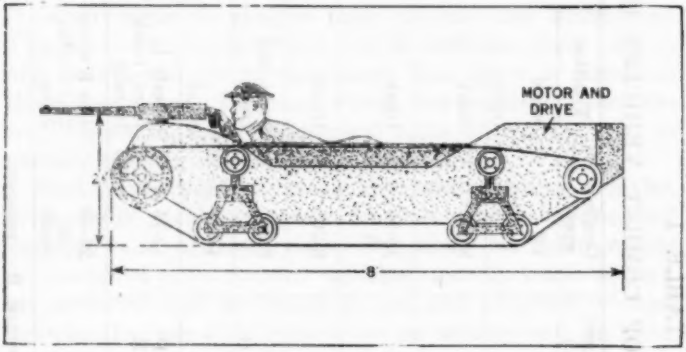

FIGURE 37.—The creeper type of one-man tank as the artist has reconstructed it. News accounts credit both the British and French with these mechanical "snakes".

It must be borne in mind that many of the surfaces on tanks are sloping and often cut up into oblique facets, thus minimizing the chance of enemy projectiles striking with a perpendicular angle of incidence. This fact is important for, roughly speaking, bullet penetration in armor plate decreases in direct proportion as the angle of impact departs from the vertical. At 30 degrees from the vertical there is roughly only three-fourths as much penetration; at 45 degrees, one-half or less; and at 60 degrees (30-degree angle of incidence), only about one-fourth as much, if any, because the projectile will usually ricochet. When

the angle of incidence is less than 30 degrees, projectiles ricochet without any appreciable penetration. In fact, bullets often ricochet upon striking armor plate at an angle only 20 or 30 degrees from normal impact. Much depends upon bullet design and remaining velocity.

It will be noted that heavy tanks were omitted from Table I. This was done because they are looked upon almost universally as unsuitable except on stabilized fronts for special break-through missions.

Motorcycles with side cars and light or heavy machine guns are used with armored cars by several European armies for distant reconnaissance missions, raids, and delaying actions. Their mission, however, is to transport

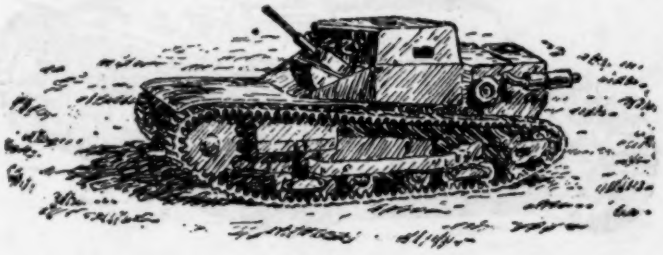

FIGURE 38.—Ansaldo-Fiat M 1933 (Italian) ultra-light tank.

their crews to firing positions and seldom are the vehicles themselves actually used in a fight. Hence they cannot be classed as mechanized vehicles.

Figures 37 to 44 inclusive show typical examples of the vehicles classified in Table I.

Having made this cursory inspection of the various types of fighting vehicles, we can proceed to the analysis of their shortcomings.

TANK LIMITATIONS

Tanks are still noisy in spite of greatly improved tracks, mufflers, and final drives. One kind of tank has a sound differing from that of another kind. The driving gears of all tanks made a whirring noise, often like that of many trucks. Track noises vary with the type, and are being reduced to a great extent in the more modern tanks. However in older models, tracks, motors, and drive me-

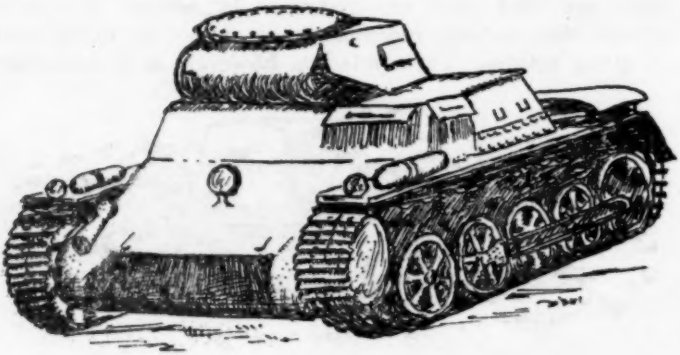

FIGURE 39.—German light tank.

chanisms are so noisy that under favorable atmospheric conditions the roar of a moving tank company or larger group is audible several miles away if other sounds do not muffle it. For this reason, under favorable conditions alert observers can detect the approach of a tank battalion when it is still a mile or more away, i.e., 5 minutes before it could strike (at 12 mph). However, when aviation or artillery create neutralizing noises, detection is difficult even a few hundred yards away.

Tanks are large, hard-to-conceal machines which air observers can readily discern when the vehicles are moving, and also when they are halted if not well concealed or camouflaged. Moreover, they cannot readily hide from

antitank gunners even when 1,000 yards away, unless operating in rugged or wooded terrain.

Yet the tanks can rarely see antitank guns at this distance, however poorly concealed the latter may be, because tanks are relatively blind when the doors are closed. None of the various vision devices tried have worked well, and eye slits restrict the field considerably. One can well understand how difficult it is to see out of a moving tank by trying to look through field glasses while riding in an automobile even on a smooth road. During the World War, guns almost always saw tanks before the tanks saw the guns. And so it is now—twenty years later. Here, then, is a big advantage for the antitank gun. Furthermore, if tanks are stopped so that the crews can orient themselves, they make an easier target. Similarly, if they open the doors to see better, they become vulnerable to rifle and machine-gun fire.

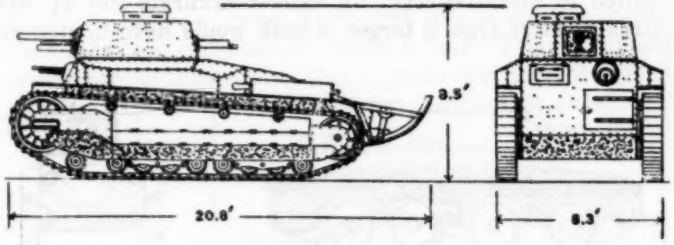

FIGURE 40.—Japanese medium M94.

The noise within a tank is so great, even in the most modern tanks, that it is impossible to hear outside noises like gun fire, near-by tanks, or sound signals. Even voice communication inside of a tank is difficult. This adds deafness to myopia as one of the tank handicaps that can be exploited by the defense. Tank crews cannot locate antitank guns by the sound of their firing, nor can they hear the burst of shells unless they are of large caliber and strike close to the tank.

We now come to the fire effectiveness of tanks. It is universally considered that machine-gun fire *from a moving tank* is relatively inaccurate beyond 300 yards; and single shots from small cannons beyond 400-500 yards.

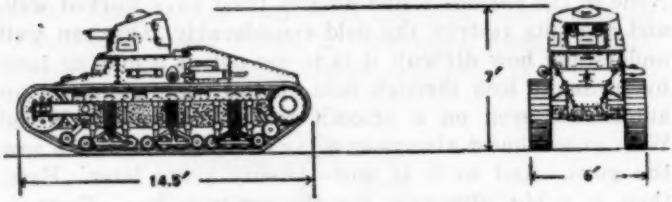

FIGURE 41.—French Renault NC2 light tank. (Similar in appearance to World War Renault.)

Even at these ranges, on rough shell-torn or obstacle-covered terrain, the effects of tank fire will be largely limited to moral effects. To deliver accurate fire at 300 yards or more from a target, a tank would have to stop or

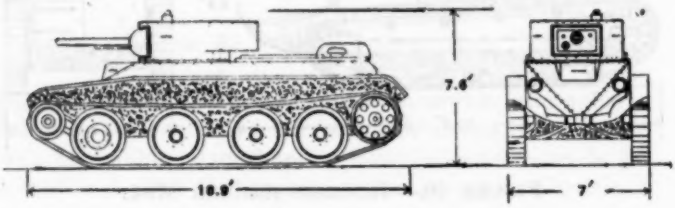

FIGURE 42.—Russian Christie medium convertible (wheel-track) tank.

at least slow down to a walking speed. But a tank cannot afford to stop unless cover can be obtained that will shield the tank and leave merely the turret exposed. Otherwise the risk is usually too great. On the other hand, stationary antitank guns can fire effectively upon tanks when they

are from 500 to 1000 yards distant, provided, of course, that the supporting elements behind the tank attack have not blinded the defending guns with smoke or smothered them with fire.

These are not the only embarrassments of tank gunners.

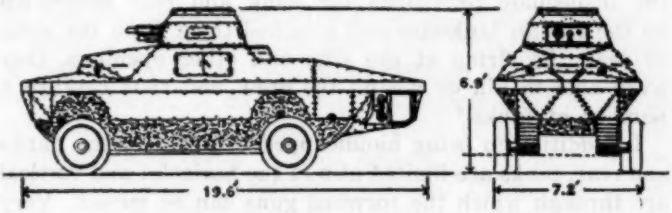

FIGURE 43.—French Schneider-Laurent convertible amphibian.

For one thing, there are no guns sited for fire to the flanks or rear in most light and many medium tanks. This condition considerably limits a tank's field of fire and means for self-protection. Nor do revolving turrents greatly mitigate this weakness, because they rotate slowly and

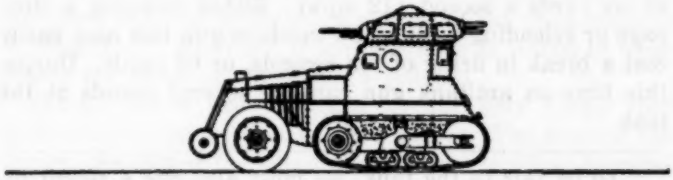

FIGURE 44.—French half-track armored car.

during this rotation the tank may pass beyond the flank target, or, in the case of an antitank gun to the flank, be struck before the tank gun can be brought to bear on its target. Lacking a rotating turret or flank guns, a tank

must turn to fire at a flank target and therefore, for an appreciable time, no tank guns will be active. Ultra light tanks (tankettes) ordinarily carry only one gun, and this, coupled with their thinner armor, makes them especially weak in the face of antitank guns. In the Italo-Ethiopian War, native tribesmen took advantage of the inadequate provisions for flank and rear protection on the Italian tankettes and attacked them from the sides or rear. By firing at eye slits and other openings, they were able to kill or wound the crew and thus capture a number of tanks.*

In addition to being handicapped in firing to the flanks and rear, tanks are limited also in the horizotal and vertical arc through which the forward guns can be moved. Very few gun mounts permit more than a 15-20 degree movement either horizontally or vertically. Hence, men in a trench a few feet in front or to one side of a tank or on the upper floors of buildings close to a tank cannot be fired upon. On account of these narrow limits of gun swing and the small number of guns in a tank, much of the area about a single tank, at any given moment, is dead space in so far as its weapons are concerned.

The time lost by a gun stoppage is dreaded in a tank, for every moment is precious when approaching the enemy at six yards a second (12 mph). Either reducing a stoppage or reloading with a new machine-gun belt may easily cost a break in firing of ten seconds, or 60 yards. During this time an antitank gun can fire several rounds at the tank.

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* To be fair to the tank, we must also cite a recent incident during the Arab riots in Palestine. A British light tank was stalled with a broken track. When the crew attempted repairs they were attacked by a band of some 50 Arabs. The crew reentered the tank and successfully defended it all night. When a rescue party arrived in the morning, 20 Arabs were lying dead about the tank as a mute indication of the value of armor plate and machine-gun fire.

It is axiomatic that success in battle is largely dependent upon effective control of all elements of the fighting force. Yet, owing to poor visibility, noise, and the very nature of tanks, control is the weakest point in tank operations. Radio communication offers a glimmer of hope to tankers but in war it too may fail. Poor control causes tank attacks to lose cohesion. Vehicles soon become scattered and thereby less capable of overcoming defensive counter measures.

Another handicap is the time limit on tank operations. A man or horse can keep going without food by tapping reserve energy. A motor-propelled vehicle must have fuel or it stops. For this reason the radius of action of a mechanized force rarely extends beyond 75-100 miles unless it burdens itself with refueling vehicles. By the same token tanks cannot keep moving all day within a hostile position; they have to withdraw to refuel. Moreover, a bullet hole through a gas tank will bring the vehicle to a stop within a few minutes.

Another reason why a tank operation has a time limit is the fatigue of the crew. While conditions inside a tank have been improved greatly since 1918, it is still crowded, stuffy, and hot in most armored vehicles, and the fatigue of the crew therefore mounts rapidly.

In this connection, attention is invited to the fact that most tanks now in use are not protected against gas. This weakness is being corrected in several of the more modern foreign tanks. However, if the tank crew is forced to wear masks its effectiveness is much reduced.

Finally, tanks are weakened by the very factor that makes them strong; that is, their armor. The heavier the armor, the slower the speed and maneuverability; likewise the greater the strain on all mechanical parts and consequently the more likelihood of breakdowns.

To reduce weight, designers keep armor to a minimum and use only thin plate where considered feasible. Bottom and top surfaces frequently carry only ¼-inch plate. Tracks often are exposed. The engine compartment may carry thinner armor than the crew compartment. All these, then, are vulnerable points where antitank gunners, and

even riflemen or machine gunners with armor-piercing ammunition, have a chance to cripple a tank. Occasions when these surfaces are exposed as in climbing over an obstacle (Figure 45) or descending a slope should be

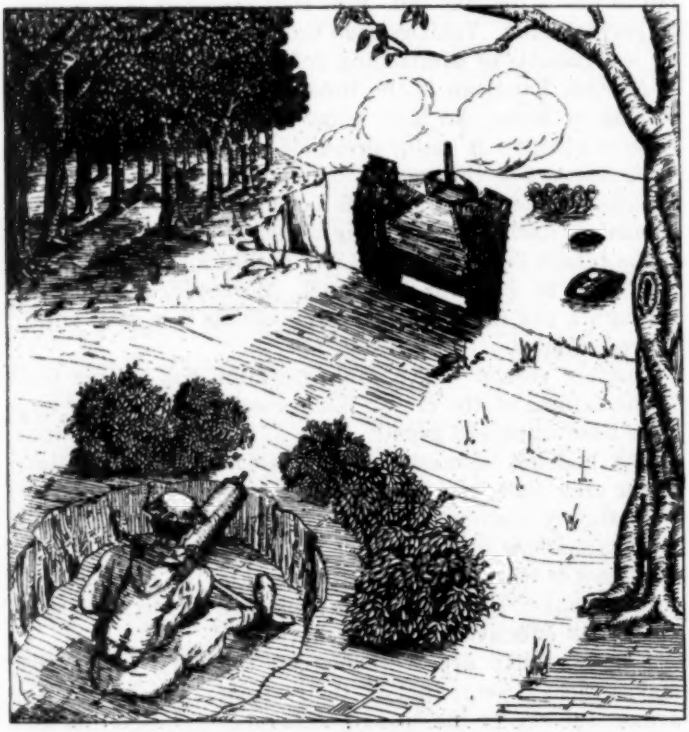

FIGURE 45.—Tank exposing thin belly armor.

utilized by the defenders.

Table II gives the charcteristics of various guns including their penetrating ability against armor plate when using armor-piercing projectiles.

It should be understood that these figures of Table II

TABLE II

CHARACTERISTICS AND CAPABILITIES OF VARIOUS GUNS FIRING AP AMMUNITION AGAINST MEDIUM ARMOR PLATE*

Weapon	Caliber inches (and mm)	Muzzle velocity ft./sec.	Rate of fire in combat rds./min.	Penetration (inches)					
				90-degree angle of incidence			60-degree angle of incidence		
				100 yds.	500 yds.	1000 yds.	100 yds.	500 yds.	1000 yds.
Rifle	0.30 (7-8-mm)	2600-3000	10	.35	.25	.15	.25	.15	
Auto rifle	0.30 (7-8-mm)	2600-3000	40	.35	.25	.15	.25	.15	
Machine gun	0.30 (7-8-mm)	2600-3000	250	.35	.25	.15	.25	.15	
Machine gun	0.50 (12-14-mm)	2500-3000	100-150	.80	.60	.45	.60	.45	.25
AT rifle	0.79 (20-mm)	2400-3000	10	1.25	1.0	.75	1.0	.80	.50
Machine gun	0.79 (20-mm)	2400-3000	50-100	1.25	1.0	.75	1.0	.80	.50
Machine gun	0.98 (25-mm)	2000-3000	50-100	1.85	1.75	1.55	1.50	1.30	1.15
Cannon	1.45 (37-mm)	1200-1500	10-20	.70	.50	.20	.55	.30	.15
Cannon	1.45 (37-mm)	1800-2200	10-20	1.30	1.15	.90	1.10	.90	.70
Cannon	1.85 (47-mm)	1600-2000	10-20	2.0	1.70	1.35	1.65	1.45	1.15
Cannon	3.0 (75-mm)	1600-2000	6	No data available for AP projectiles for release					

* The penetrations given in this table are taken in most cases from published data. Their accuracy cannot be guaranteed. Where statistics have not been available for certain weapons, assumptions have been made based on other firings and on the capabilities of similar weapons.

are not constant results obtained with all types of projectiles of the caliber indicated whenever they are fired under the conditions shown. Quite the contrary. Results vary widely and often unaccountably under different circumstances. There are many different types of armor plate, some more yielding and some more resisting to armor-piercing projectiles. Moreover, not only range, angle of incidence, and velocity affect perforation, but the design of the projectile also is important—at different ranges and different angles of incidence the shape must be altered for best results. Ricochets often occur with some types of projectiles when the angle of incidence is more than 20 degrees from normal (90 degrees). In general, the greater the caliber, the less likely are ricochets, because of the greater mass.

Ultra high velocity bullets like the Halger and Gerlich which attain the speed of 5000-6500 feet per second at the muzzle, have roughly double the penetrating power of conventional armor-piercing bullets of 2500-3000 foot-seconds muzzle velocity. Fortunately for tanks, and unfortunately for antitank defense, barrel erosion, inaccuracy, and construction costs must be overcome before these bullets will be practical for use in ordinary rifles and machine guns.

It must be remembered that tanks are expensive and cannot be built rapidly even under wartime pressure. It is not probable, therefore, that any commander will fritter away his tanks on minor tasks; rather he will try to conserve them for the decisive time and place. This thought should be kept in mind in allotting anti-mechanized means to subordinate units. Armored cars can be built on stock motor car chassis and therefore at a lower cost and at a faster rate. Hence, armored cars may be used more freely by the enemy, but ordinarily not against well organized defensive positions with obstacles and means of fire for opposing combat vehicles.

We now come to the matter of obstacles to tank movement. First in importance are water courses. Tankettes cannot ford more than 1½ to 2 feet of water; light and

medium tanks not more than 2½ to 3 feet. Stream bottoms must be hard, and banks not too precipitous. Amphibious tanks are not troubled by water but may flounder before steep banks.

Associated with streams as obstacles are all forms of cuts, gullies, canyons, and also trenches too steep for tanks to ascend or descend, and too wide for them to span. Very fast tanks with good suspension systems can jump trenches that are not too wide. Slower tanks can use bridging devices but are delayed thereby and made more vulnerable to gun fire.

Marshes or even deep sand and mud can also stop or at least retard tanks.

Woods are usually considered as obstacles to tanks. It is a fallacy, however, to rely upon any kind of woods as a barrier which tanks cannot pass. It is true that individual trees of considerable size cannot be pushed over except by heavy tanks, but these can be avoided, and small trees up to one-half foot in diameter, and even larger ones, are readily pushed over by all except light tankettes. Oftentimes, indeed, tanks will leave open ground and advance through woods in order to obtain cover from hostile observation and fire. To be sure, their progress will be slower in woods, but it will be safer.

However, dense woods, or cut-over woods containing numerous stumps and fallen trees, or woods where there are numerous streams, gullies, or trenches, considerably handicap tank movement. Thus we may say that certain types of woods, or woods that have been prepared for antitank defense, are serious obstacles to tanks.

Stone walls, buildings of solid construction, and all objects of steel or concrete are also barriers to tanks.

The ground clearance of tank bottoms varies from less than a foot up to a foot and a half. Hence, it can readily be seen that a boulder or solid stump higher than this may cause a tank to "belly". Thus we must add fields of stumps and boulder strewn ground to the list of natural tank obstacles.

As a consequence of all this, oftentimes tanks will have

to stop, back up, and turn to avoid obstacles, mines, or traps. Then they present easy targets.

Turning to armored cars, both of the half-track and all-wheel varieties, we find many of the same weaknesses as in tanks. The exceptions are obvious. There are several other weaknesses, however, not found in tanks. These are: very thin armor often vulnerable to caliber 0.30 AP bullets at short ranges, and even unarmored surfaces; vulnerable tires on certain types; movement limited to roads or hard ground (except half-track vehicles); more sensitive to ditches, cuts, water courses, marshes, sand, and mud than track-laying vehicles.

Summing up all that has gone before we arrive at the conclusion that these are the main deficiencies and vulnerable features of armored fighting vehicles which should be considered in preparing defensive measures:

(1) Characteristic noise, audible at a distance;

(2) Size, facilitating detection;

(3) Blindness of crews (cannot always see targets or enemy AT guns);

(4) Deafness of crews (often cannot hear shell burst or discharge of enemy guns);

(5) Relatively ineffective fire beyond 300 yards, except when halted;

(6) Difficulty, with most tanks, of firing to flanks or rear without turning the tank; therefore a large dead space, at any given moment, about each tank;

(7) Limited traverse and elevation of tank guns (targets close to tank may be out of field of fire);

(8) Poor control, disintegration of tank formation;

(9) Fatigue of crew;

(10) Vulnerability to gas;

(11) Vulnerability to gun fire (thin bottom and top armor);

(12) Paucity of tanks and difficulty of replacing.

Added to these are the natural obstacles to tank movement, namely:

(1) Water courses;

(2) Gullies and steep banks;

(3) Marshes;
(4) Deep mud and sand;
(5) Certain types of woods;
(6) Fields of stumps;
(7) Boulder strewn terrain;
(8) Buildings of solid construction.

Finally, the peculiar weaknesses of armored cars: thin armor, vulnerable tires, restriction to roads and hard ground.

It may seem from the foregoing that the limitations of tanks and their vulnerability to counter measures are so great that tanks are no longer a dangerous weapon. Lest this impression be gained, attention is invited to the achievements of the crude machines of the World War. Modern tanks are far superior in every respect and are constantly being improved. This increasing efficiency of tanks makes the antitank problem more difficult. Tanks have overcome obstacles and deficiencies in the past and may be counted on to overcome even greater handicaps in the future. But they are not all-powerful juggernauts. And the more effective the counter measures, the less effective will be the tank action.

CHARACTERISTICS OF MECHANIZED ATTACKS

The next question that comes to mind is how will enemy mechanized attacks be made? Where can they be expected? When are they likely to strike? What sort of force will be used?

It goes without saying that the answers to these questions are legion and at best can only be conjectures based partly on the few existing historical examples of mechanized attacks and also upon methods currently taught or advocated in various armies. The opinions of leaders in the realm of mechanization are at variance on many points, but there are a few tenets acknowledged by the majority. To these and current methods we turn, then,

to provide a premise upon which to base our further discussion of counter measures.*

Tanks were originally created to break through barbed wire entanglements and destroy machine guns. They operated in the World War to pave the way for the accompanying infantry, or, in several instances, as tremendous battering rams to push a hole straight through the enemy dispositions. They had to strike in this way in order to break the fortified zone extending from Switzerland to the English Channel.

The latter method of employment in mass, with successive waves penetrating deeply in hostile territory, by frontal or flank attack, is considered best today by most tank exponents of European armies—with the possible exception of France. By attacking in mass is meant the use of from 100 to 300 tanks disposed in depth for each mile of front—in decisive areas—so that wave after wave rolls over the enemy lines. This, obviously, is intended to smash a hole in well-nigh impregnable fronts such as those of 1914-18, or drive deeply into rear areas from a flank.

In France limited attacks by infantry-accompanying tanks are favored. These would attack in the ratio of about a battalion (45-60 tanks) on a division front.

Thus as we can see that national doctrine, terrain and tactical situation will dictate the method of using tanks. But in any event the defender must be prepared to meet these two types of threats: (1) tanks as part of a mechanized force striking far around the flank toward rear areas or else exploiting a breakthrough; (2) tanks operating in conjunction with infantry making the main attack for the purpose of gaining an immediate tactical objective.

But whatever the tank method used, little difference will be apparent to infantry. The actions of individual tanks, tank platoons, and companies will be much the same whether they are part of a mass attack by an independent armored force or are accompanying an infantry

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* Volume XII, Mailing List, outlines the tank doctrine of several European powers.

attack. In either case their actions will be governed primarily by the terrain, natural and artificial obstacles, visibility, fire power, and tank capabilities. These will vary in every situation. Yet we do know this much: There will be an interval of 35-100 yards between tanks and from 200 to 600 yards distance between successive waves. Individual tanks will zigzag forward to avoid obstacles and to utilize all available cover protecting them from known or suspected antitank gun positions. Crews will probably do no firing until they see or think they see enemy positions. They may thus get up to 200-300 yards from the defenders' positions before they fire.

The amount of tank fire in the World War was small. A French corporal was decorated for his accomplishments in a World War tank action in which he was a tank commander. When asked how many rounds he had fired from his machine gun during the day, he replied, "Ninety-six." Presumably potential targets fled before he arrived. In the future, can tanks expect to create so great a demoralizing effect?

CHAPTER 9

Defense against Mechanized Attacks

(INFANTRY SCHOOL TEACHING)

The preceding chapter completed a brief survey of tank characteristics, weaknesses, and operating methods. From that discussion the reader will no doubt have made various mental notes of how he would oppose tanks with given means. The important factor is: what means of antitank defense will be available?

The usable means are ordinarily classified as passive and active. The passive means of defense that may be used to advantage are natural obstacles like rivers, precipitous ravines, cliffs, steep embankments, marshes, dense woods, stump covered fields and boulder strewn terrain; and artificial obstacles like sturdy buildings, stone walls, canals, inundations, felled trees, logs, tank trenches and traps, iron or cement posts, road blocks and bridge destruction.

ACTIVE MEANS OF ANTITANK DEFENSE

The principal active means are reconnaissance, guns, tanks, and mines, although, strictly speaking, mines are a passive means of defense. In general, guns suitable for antitank defense should be at least caliber 0.50 or larger, and preferably one inch (25-mm) or larger with muzzle velocities above 2,000 feet per second. However, against thinly armored combat cars or lightly armored tankettes the caliber 0.30 armor-piercing bullet will do damage under 200-300 yards. Particularly is this true when the thin top or bottom armor is exposed.

In our army at the present time we have only three guns within the infantry division that are reasonably well suited to antitank defense. These are the 75-mm gun of light field artillery, the 37-mm gun model 1916, and the caliber 0.50 machine gun. In the new infantry regiment,* there are twelve of these heavy machine guns organized into three platoons which comprise the antitank company of the Special Weapons Battalion or 4th Battalion. In this organization the 37-mm gun no longer has a place.

For obvious reasons, the 75-mm gun, because of its large size, great weight, and other missions that it must perform, should not be diverted to antitank defense except in emergencies. At the present time, however, we do not have an antitank gun of adequate caliber and muzzle velocity for general use, so the 75-mm field piece must be considered as the heavier type of antitank gun that would ordinarily be used in rear of the forward areas of a position.

In Table II we saw that the caliber 0.50 gun was capable of penetrating only about ½ inch of armor at 500 yards. Consequently, it can profitably be used only for the close-in defense of infantry and other combat units. Until a more appropriate gun is adopted it is the principal reliance of the infantry regiment.**

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* See Chapter 1, Volume XI, Mailing List.

** An opinion is slowly crystalizing that an antitank gun is needed of between one and two inch caliber with sufficient muzzle velocity to penetrate at least 1¼ inch of armor at a range of 1,000 yards, even though the shell strikes at an angle 20 degrees away from the normal angle of impact (90 degrees). In firing position this gun should not weigh over 600 pounds in order that two men can move it. Moreover, it should be capable of moving rapidly across country. This requires the gun to be self-propelled, or that it have a light cross-country towing vehicle. A frontal sheld of armor able to withstand small arms fire would be desirable to protect the crew, if the added weight did not materially reduce mobility.

In general, it is not considered desirable to use tanks as antitank weapons, principally because they are designed primarily for missions calling for mobility and shock action as well as fire power, and also because they are costly and difficult to replace. However, when armed with a suitable small cannon they can readily act as powerful antitank weapons. This is particularly true of most medium tanks. They have the requisite mobility, crew protection, and armor penetrating ability. In any case the tanks should be held together to counterattack and not be dispersed as is often done with antitank guns. In cases where an armored attack threatens a column on the march, or where an area is lacking in the usual antitank defenses, then organic or attached tank units constitute an immediately available defensive means at the disposal of a commander.

Full use should be made of available air forces in locating, reporting, and bombing tank concentrations in rear areas. It is expected, furthermore, that attack aviation armed with bombs may be used against large bodies of wide maneuvering tanks.

Gas also can be used effectively to delay and even partly disrupt a tank attack.

Antitank mines are land mines of either the controlled or contact type—usually the latter—which are buried in the ground or scattered on the surface and camouflaged. One disadvantage of mines lies in the large number required to create an effective barrier. This means great weight; thus the amont of transport required to deliver the mines and the number of men needed to place them often precludes their use with the density desired. If the front is driven or drawn back, the mines may be sacrificed. If moved forward, the mines will have to be moved also. Furthermore, in mobile warfare, mines usually must be scattered on the surface, and rarely can be used in adequate quantity.

Yet it cannot be denied that the most effective artificial tank barrier is a well-laid mine field. It has a high moral and tactical effect, and may often be the only practicable

means of joining the natural obstacles protecting a defensive position. Also there is a possibility that tank mines can at least be recovered and re-used when a position is changed, something which cannot be done with tank trenches, traps, and other prepared obstacles.

Other active means of defense credited with varying degrees of effectiveness against tanks are gas and smoke, and rifle and machine-gun fire at eye slits, pistol ports, and other openings to cause lead splash. (The eye slits of modern tanks, of course, are better protected than World War tanks against lead splash).

Expedients that have been used with minor success in the past are: grenades tied together and thrown at a tank track or under a tank; any sort of destructive means like a rifle barrel or crowbar run through a track mechanism to throw it or break it; gasoline or petroleum sprayed from airplanes or thrown in glass containers against tanks and ignited by incendiary bombs or grenades; brush or dry grass or grain set afire in order to drive out or destroy attacking vehicles. Such means, however, are crude makeshifts, well worth knowing and using in emergencies, but not to be considered in planning organized defense measures. They are last resort measures to be used by troops lacking more effective means.

HISTORICAL DATA ON ANTITANK DEFENSE

The 1,949 French tanks that actually were engaged in the 1917 and 1918 fighting of the World War participated in 26 battles and skirmishes. In all the engagements the French actually lost 748 tanks; of these 657 were destroyed by cannon fire, 16 by mines, 4 by infantry machine-gun fire (and flames), and 71 by unknown causes.

The British lost about 1,000 tanks, all by cannon fire, except for 20 by mines, 4 by antitank rifles and hand grenades, and 6 by German tanks.

From these figures, the cannon is revealed as the most dangerous weapon for tanks. Mines became progressively more dangerous toward the end of the war.

Our most recent data on antitank defense measures are from Ethiopia and Spain. In Chapter 8 we saw one example of how the Ethiopian tribesmen attacked Italian tankettes. Another example of a defense expedient was the setting fire to brush to deny a particular area to tanks. On one occassion tribesmen boarded tanks and hurled boulders down upon the tank guns, bending them so that they were no longer usable.

In Spain two tank attacks were stopped by an aggressive defense. Bottles of gasoline were thrown at the attacking machines; these were followed by hand grenades which, upon detonation, ignited the gasoline and made of the tanks flaming coffins from which few escaped. Those that got out were shot down, just as occurred in another attack when petroleum-soaked straw placed in the path of the tanks was set afire by tank exhaust, and enveloped tanks and crews in flames.

These measures taken in Spain and Ethiopia must, of course, be considered largely as expedients—efficacious in minor operations and local actions, but seldom applicable against a major tank operation.

CONCLUSION AS TO PRIMARY ANTITANK DEFENSE MEANS

The above World War statistics show that the primary means of antitank defense is gun fire. Mines are difficult to use in mobile warfare and are far less effective than the aimed fire of antitank guns. As for natural and artificial obstacles, oftentimes the former will not be present and the latter impracticable to construct. This leaves antitank guns as the most dependable, the most convenient, and the most effective means for stopping armored combat vehicles. However, within the requirements of the situation, every effort should be made to find and utilize natural obstacles, and to supplement them with artificial obstacles as far as time and material will permit.

But even with a good system of obstacles, early warn-

ing of an impending attack must be given to antitank units so that they can be ready before the tanks overrun the position. Since the probable path of attack can often be deduced from reports sent in while the tank force is still at a distance, it is feasible to strengthen the threatened point by moving reserve antitank units into suitable positions or even shifting antitank units from a quiet area to the threatened area. It must never be forgotten that tanks are speedy vehicles; therefore, to permit the above shifting, adequate reconnaissance agencies and a rapid system of communication are necessary and become vital adjuncts of antitank defense.

Control is implied as a prerequisite of all military operations, but it becomes especially important in defensive measures against mechanized attacks. At present we have no anti-mechanized unit outside the regimental antitank company. It seems highly desirable to have at least a divisional antitank unit. If such a unit is organized, then the antimechanized defense as a whole should be under centralized control to insure coordination of all active and passive defense measures, and also to tie in with the antitank defense provided by the organic antitank companies of infantry regiments. The officer ressponsible for this coordination will need ample means of signal communication and enough men and vehicles, preferably motorcycles or light cross-country cars, to enable him to coordinate and control the agencies under him.

Summing up the major elements in antitank defense, we have the fire of antitank guns as the framework. Coordinated with it are the auxiliary means—natural and artificial obstacles, supplemented by mines. The whole is dependent on efficient reconnaissance and a speedy alarm system.

AGENCIES PARTICIPATING IN ANTITANK DEFENSE

From the pages immediately preceding, it can be seen that several arms may assist infantry in providing for

its antitank defense. Divisional artillery may provide gun fire, either indirect-laying concentrations on tank bivouacs, assault positions, and assembly points or else direct laying by individual pieces used as antitank guns. Engineers may prepare demolitions, assist in the preparation of barriers and obstacles or furnish material therefor, provide and even lay antitank mines. Observation aviation, mechanized cavalry, and all other reconnaissance agencies are means that may be used to obtain information of hostile mechanized movements. Attack aviation may intervene in emergencies to disrupt the hostile operation. At times chemical troops may assist by firing smoke or gas from chemical mortars.

With all due credit to the value of these arms in providing antimechanized protection, much of the close-in defense of infantry against armored vehicles must be provided principally by infantry itself. The weapons of the antitank company in the 4th Battalion (new regimental organization) are its primary means for this defense.

The antitank company as now organized in the new infantry regiment consists of three platoons, each provided with four caliber 0.50 machine guns. Each gun with its gun squad is carried on a light truck. These platoons may be retained under control of the Fourth Battalion of the Regiment, but in most situations they will be attached to rifle battalions. Occasionally platoons may be broken up and single guns attached to rifle companies or platoons. Of this more later.

Our present organization makes no provision for reserve antitank-gun companies within the division. Having the caliber 0.50 machine gun with its short effective armor-piercing range as our only special antitank weapon at present, little could be gained by constituting a reserve of antitank guns, because these guns are suitable only for the close-in defense of combat units. They are unsuitable for supporting roles requiring longer ranges. However, when a larger gun of greater effective range and penetrating power is adopted, it is anticipated that an anti-

tank battalion will be a part of divisional special troops.

In problems at the Command and General Staff School it is assumed that such a unit exists in the division, and that its usual mission is to provide protection for units of the division in rear of the forward infantry organized areas. When all-around antitank defense is required, a part of this battalion may be used to reinforce the regimental antitank defense in critical areas. However, in actuality, divisional artillery, or light artillery furnished by higher units, is the only reserve of guns available to augment the fire of regimental antitank companies.

Reinforcing light artillery is allotted for the defense of a sector when the terrain is suited to a tank attack and the situation indicates that tank attacks are imminent. When tank attacks in force are expected but the point of attack cannot be determined, light artillery may be held where it can be rapidly dispatched to previously reconnoitered and prepared firing positions from which the likely avenues of tank approach can be covered.

When the commander has reason to expect a tank attack in force, the artillery defense is organized according to the system outlined below.

1. Concentrations are prepared, to be fired on call, on probable enemy tank assembly areas and probable routes of approach therefrom, particularly any defiles—like bridges—over or through which the tanks are likely to pass.

2. The outpost artillery batteries are each given a tank defense zone within the outpost area.

3. Light guns may be posted between the main line of resistance and the regimental reserve line of the main battle position covering the most probable avenues of tank approach.

4. Individual light guns may be posted along the regimental reserve line of the main battle position, to cover weak points in the main line of resistance along routes of probable tank attack.

5. Each light gun battery behind the main battle posi-

tion is assigned sectors for defense against a tank attack that may penetrate the defensive position.

ORGANIZING ANTITANK DEFENSE

With the foregoing study of tank characteristics, tank attack methods, and various defensive means in mind, let us examine the actual methods used by infantry units to defend themselves against mechanized attacks.

The regimental antitank company is the only definite antitank organization now provided. Since this is so we can only determine, for the present, how best to use it in conjunction with the auxiliary means which may be available. This company must provide protection against armored attacks in the following situations:

(1) On the march.

(2) In attack and pursuit.

(3) In defense.

(4) During retrograde movements—withdrawals and delaying actions.

(5) And in all kinds of special operations.

ON THE MARCH

During a march when contact is not imminent and there is no immediate threat of mechanized attacks, the only hostile vehicles likely to be encountered are light armored cars, scout cars, and motorcycle machine-gun elements on reconnaissance missions. These are not a serious threat to any force marching in several columns with aerial reconnaissance, motor patrols, and reconnoitering detachments covering its front and flanks while advance and flank guards provide close-in security. (See Figure 46.) Hence, antitank guns may move by platoons or sections in the intervals between units or, if there is no danger of attack, the entire company may remain together and march with other motor elements.

However, as contact becomes more imminent, most of the guns are distributed singly throughout the main body,

the advance guard, flank guard, and even the rear guard. (See Figure 47.) If artillery is present it can be expected

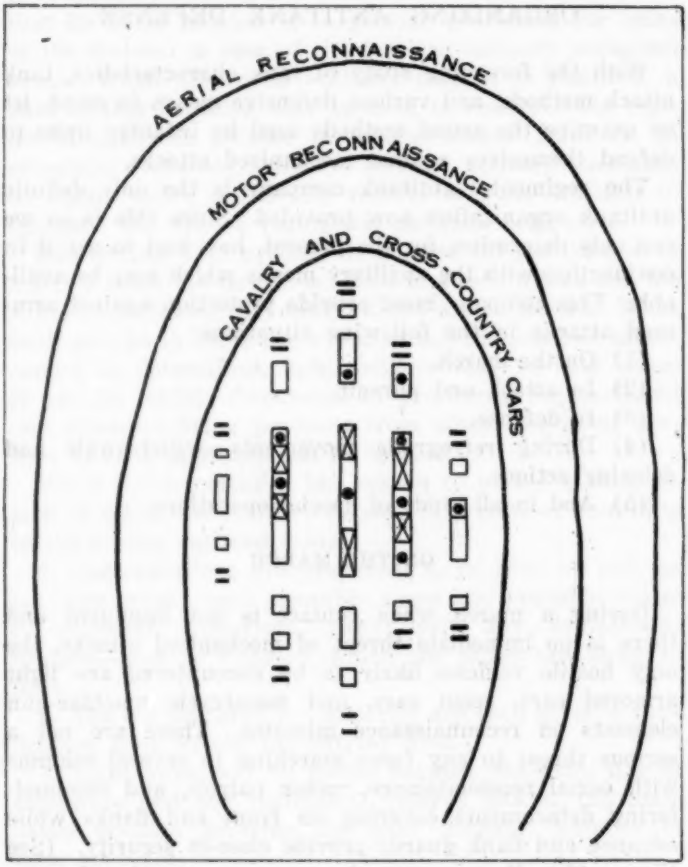

FIGURE 46.—Diagrammatic representation of antitank defense on the march.

to render considerable antitank protection. Ordinarily a force the size of a division or larger, and even smaller

forces, march in two or more columns. Each column may allot from 1/6 to 1/3 of its antitank weapons to its

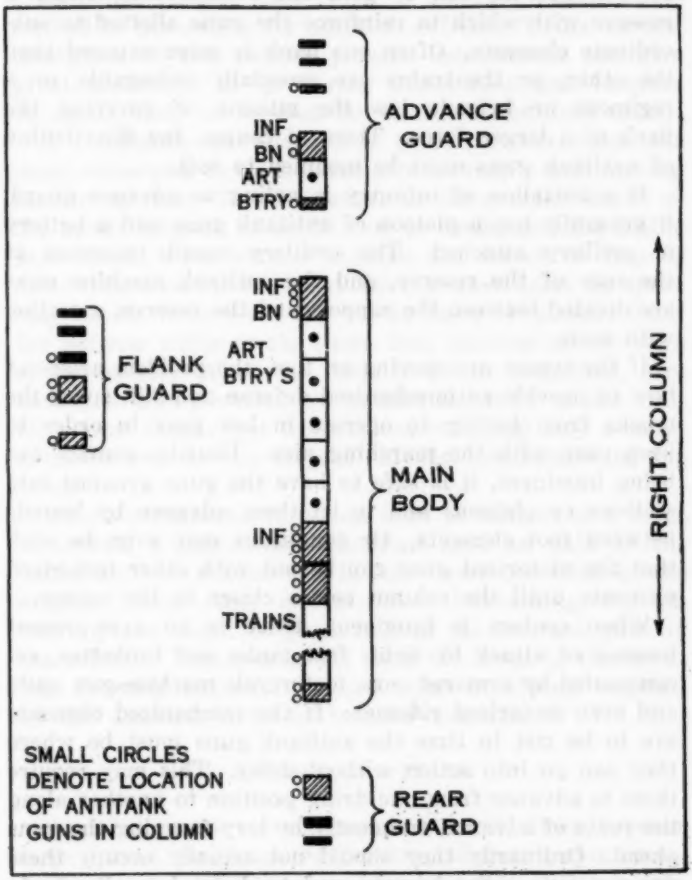

FIGURE 47.—Caliber 0.50 machine guns with advance, flank, and rear guards.

advance guard; and at the same time a like amount to the flank guard and to the rear guard, when the situation

calls for these latter security elements. The remaining guns are retained in the main body to provide for its close-in defense and to give the column commander a reserve with which to reinforce the guns allotted to subordinate elements. Often one flank is more exposed than the other, or the trains are especially vulnerable, or a regiment or brigade has the mission of covering the flank of a larger force. Then, of course, the distribution of antitank guns must be modified to suit.

If a battalion of infantry is acting as advance guard, it generally has a platoon of antitank guns and a battery of artillery attached. The artillery usually marches at the rear of the reserve, and the antitank machine guns are divided between the support and the reserve, a section with each.

If the troops are moving on foot, the problem arises of how to provide antimechanized defense and still spare the trucks from having to operate in low gear in order to keep pace with the marching men. Usually, contact not being imminent, it is safe to have the guns grouped into sections or platoons and to let them advance by bounds between foot elements. Or conditions may even be such that the motorized guns can be put with other motorized elements until the column comes closer to the enemy.

When contact is imminent, there is an ever-present menace of attack by light, fast tanks and tankettes, accompanied by armored cars, motorcycle machine-gun units and even motorized riflemen. If the mechanized elements are to be met in time the antitank guns must be where they can go into action without delay. This may require them to advance from one firing position to another along the route of advance, frequently by leap-frogging the guns ahead. Ordinarily they should not actually occupy these firing positions but be prepared to do so immediately in case warning of an armored attack is received.

Of course, the terrain and natural obstacles will often prevent a flank incursion except over the roads leading from the flanks. In such cases it would be wasted effort continually to leap-frog antitank elements along the route

of advance. Rather they should take positions to cover the routes of approach leading from the flanks until the column has passed, then move to the next location prescribed in the orders for antitank defense. Under terrain conditions of this nature, pioneer detachments can give great assistance by preparing demolitions and barriers on roads likely to be used by hostile mechanized units.

A completely motorized unit is, in several ways, far more vulnerable to mechanized attacks than a unit moving mainly on foot. This is because of the greater length of the motor column, its restriction to roads, and the traffic jam caused when several vehicles are forced to stop or are wrecked on the roadway. On the other hand, its speed may enable it to elude the hostile force or dispose itself for defense while at the same time barring the advance of the enemy. When the force is wholly motorized, protection is best provided by distributing most of the antitank guns throughout the column, retaining only a minimum reserve at the disposal of the commander of the force.

Where a regiment forms an interior column of a force of several columns, less attention need be paid to the flanks and more guns can be kept near the head of the column. Thus, other circumstances warranting, the advance guard might be given half of the antitank guns in the column. The approaches from the front in the intervals between adjacent columns must be closely watched by the antitank units of interior columns.

DURING AN ATTACK

So-called meeting engagements are not likely between large forces, owing to the far-flung distant motor reconnaissance and other security elements that all large commands maintain to their front and flanks.

However, small units like battalions, regiments, or even brigades on independent missions, may meet the enemy under circumstances giving little time for deployment and preparation for battle. When opposing forces suddenly

make contact, each will seek to feel out the other and attack him without delay if the mission so demands and there is a chance of success. This being the case, it is highly probable that any light, fast, armored elements available will be used both by the adversary who succeeds in attacking and the one who is forced to defend. The attacker will use his combat vehicles to envelop or outflank the hostile force, while the defender will use his own to thwart the turning movement by striking a counterblow wherever the assailant appears to be weakest. He may, for example, attempt to disrupt the threatened attack by a swift armored blow on troops still in their assembly areas, though these assembly areas will more than likely be covered by antitank weapons.

Antitank units must therefore be thrown out with the rifle and machine-gun elements of the advance guard or covering detachment protecting the deployment. This is the critical moment when the attacking units are especially vulnerable. At this time, too, our own tank units, if present, must be in readiness to counterattack if the enemy strikes at us.

When our attack is made, the threat of a hostile counterattack by tanks or infantry supported by tanks becomes progressively more probable. The nature of the terrain may indicate likely avenues of counterattack but will not, in the usual case, warrant attachment of the antitank guns to subordinate elements unless these elements are separated from the regiment. Rather, to insure flexibility and adequate guns where needed, the regimental commander generally will retain the entire antitank company under his control.

The antitank company is usually disposed, by platoons, in width and depth. In siting guns particular attention must be given to the antitank protection of forward elements and to areas over which hostile tanks are most likely to operate.

Continuous ground reconnaissance for suitable gun positions should be made as far forward as the progress of the attack permits and, in addition, a study should be

made of maps and aerial photographs to select tentative positions within the area occupied by the enemy.

PURSUIT

In pursuit, conditions for antitank defense are similar to conditions when initially attacking. Hostile mechanized counterattacks and delaying actions must be broken up by pushing antitank elements well forward where they can engage and defeat the armored forces of the enemy before they gather momentum and arrest our own action.

ANTITANK DEFENSE IN A DEFENSIVE SITUATION

The whole experience of modern warfare has shown the desirability of organizing a deep area for defense, rather than a shallow strip. Against a deep defense, an attacking enemy no sooner gains a foothold at one spot than he is faced with the task of fighting just as hard to gain the next. His attack loses momentum, wears itself out, and finally wavers and stops. Moreover, the defending troops are scattered to such an extent that casualties from the hostile supporting fires are reduced. Depth also insures flexibility, permitting the movement of defensive fires and troops to meet developments. Finally, a deep defense is not disrupted if the attackers gain part of the position. A deep defense is particularly suited to resist a mechanized attack, because the enemy vehicles are prevented from exploiting to the maximum two of their principal characteristics—fire power and shock action. Their other two, mobility and protection, avail them little when, in order to attack suitable targets, they have to search wide and deep through obstacles that delay their progress and weapons that use this delay to accomplish their destruction. The deeper tanks have to go against organized resistance, the greater will be their loss of cohesion, coordination, and momentum.

Hence the modern battle position is usually a belt of terrain a mile or more in depth, and in a deep zone de-

fense, oftentimes there are one or more reserve battle positions organized by other units in rear of the first. The degree of depth depends on the mission and upon the enemy armament and fires. The depth of a battalion sector may vary from 500 to 1500 yards; of a regiment, from 1000 to 2000 yards. Behind are brigade and division reserves.

In delaying actions, depth is often sacrificed, owing to the greater width of front that must be defended by small forces.

Antitank defensive measures become organized more completely and adequately in the same degree that the defensive position as a whole is perfected. Hasty measures only are possible in a deployed defense; these measures are improved as a battle position is prepared; and in a prolonged defense a well-coordinated system can be evolved for meeting armored attacks.

The holding forces of the main battle position occupy and organize important tactical localities or defensive areas. These are often elevations, but may be woods, villages, or other places that are suitable or must be denied the enemy. These defensive areas should be selected with a view to the observation and fields of fire they afford. Also, when a passive defense is contemplated, the position should be selected with consideration given to the ease with which it can be defended against tank attacks. Thus, wherever practicable, the position should have to the front and flanks natural or artificial terrain obstacles, such as streams, gullies, embankments, woods, slashings, buildings, ditches, antitank mines.

DEFENSE WITHIN A REGIMENT

THE ANTITANK COMPANY

Upon receipt of orders for the occupation of a defensive position, the regimental commander usually makes a reconnaissance before issuing the regimental order for the defense of the assigned sector. While making this

reconnaissance the regimental commander will ordinarily be accompanied by the commander of the 4th Battalion.

After his reconnaissance, the regimental commander issues the regimental order for the occupation and organization of the sector. The battalion commander 4th Battalion may then be ready to issue his order for the employment of the 4th Battalion, or, more likely, it may be necessary for him to make a further reconnaissance. The antitank company commander may then receive his instructions for the antitank defense of the sector from the battalion commander 4th Battalion. This will be the case when the regimental sector has natural or artificial tank obstacles that would cause a tank attack to be canalized or restricted in direction so that the antitank guns could all be employed effectively under regimental control. However, in most situations it is probable that the platoons of the antitank company will be attached to rifle battalions by the regimental order. When so attached the platoon commanders will receive instructions from the rifle battalion commanders.

The terrain within the sector and adjacent to it will be the governing factors in disposing the antitank platoons. Figure 48 shows an example of a disposition to cover a probable tank attack from any direction. Here each of the forward rifle battalions has an antitank platoon attached, the third platoon being with the battalion whose combat groups are along the regimental reserve line. Obstacles, of course, may cause the distribution to vary so that a preponderance of guns may be placed in areas not protected by obstacles.

Communications should be established through the nearest command post. In addition, the company or platoon commander should arrange with near-by rifle units to give his antitank guns protection against raids, patrols, or enemy penetrations, particularly where guns are located outside of organized tactical localities. There must be mutual assistance between the commanders of antitank elements and of adjacent combat groups.

Several positions are prepared for each gun in order

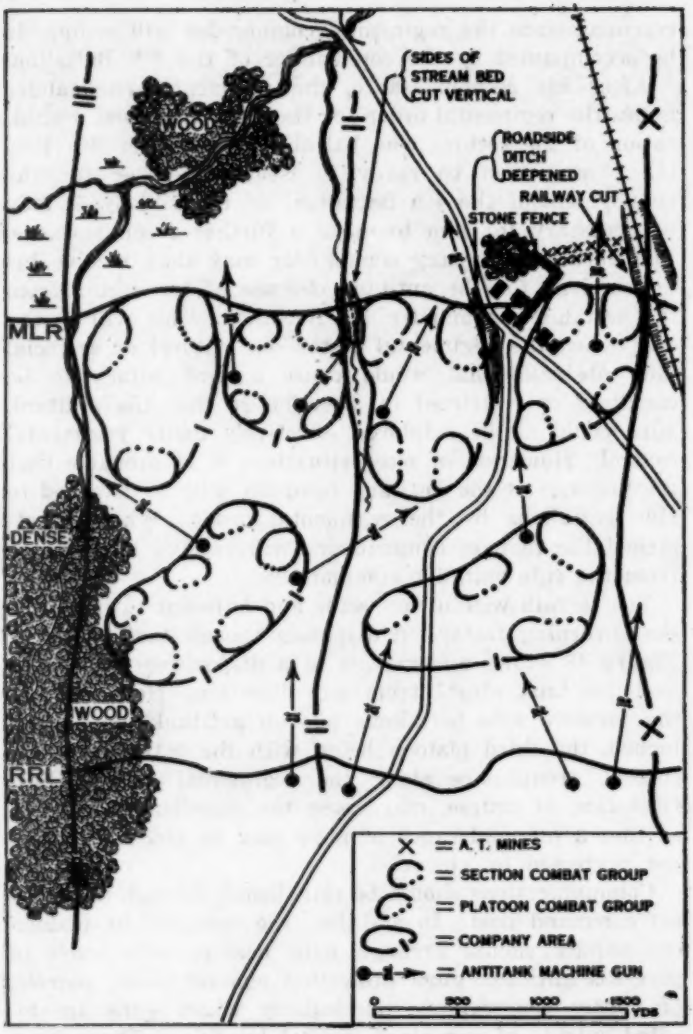

FIGURE 48.—Regimental antitank company disposed for defense of regimental sector (sketch).

to cover the various approaches to the area it protects and also to give alternate positions to move to if discovered and fired upon by the enemy. Positions are selected, perferably outside of combat groups, on commanding ground offering an excellent all-around field of fire. Forward guns may have to be located in combat groups for their protection, and to obtain good fields of fire.

The antitank guns remain silent in their concealed positions until hostile tanks attack. If not already in a position suitable for meeting the attacking tanks, the guns must be put quickly in the position best suited to meet them. Fire will be withheld until enemy tanks come within effective range (rarely over 500 yards for caliber 0.50 machine guns), and the fire should be heavy and continuous until the hostile tanks have been stopped or have passed out of range. Thereafter immediate movement to other positions is recommended, for once antitank guns have disclosed their positions they are certain to draw heavy fire. For this reason, they should never fire on personnel or other targets, except in emergencies requiring them to fire for their own protection.

It must be remembered that the fires of other supporting weapons also enter into the scheme of antitank defense, and the fires of the regimental antitank guns should be coordinated with those of other supporting weapons in order to create an effective combination.

OBSTACLES

Let us now turn from the antitank guns, our primary defense, and look into the matter of obstacles, both natural and artificial (man-made). We cannot hope to find many positions that are protected throughout by natural tank barriers, so that man-made obstacles will be necessary to positively close certain approaches to our position and render other stretches of the front difficult for tanks. By these preparations we may be able to canalize the enemy tank attack into localities where, of course, our antitank guns will be massed. (See Figure 49.)

Therefore, within the limits of the sector assigned by higher authority, all infantry commanders must select positions that lend themselves to defense against armored attacks. Commanders of rifle and machine-gun companies and platoons often have scant latitude in disposing their units. Yet in many cases they can find an eroded gully, a clump of trees, a steep bank, or a few stumps that

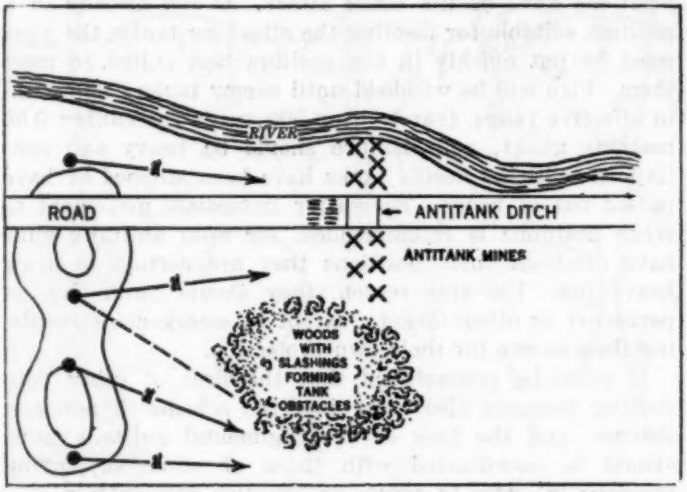

FIGURE 49.—Antitank obstacles with mines.

afford partial protection, which with a few hours' work could be made into a formidable barrier—at least in one direction. If these scattered obstacles are joined by well-placed and well-camouflaged mine fields, and a strong force of antitank weapons complete the ensemble, nothing but a mass tank attack will be able to get through, and then only with heavy casualties.

What work can be done to improve existing obstacles or create new ones? Suggestions answering this question will be limited to a few brief statements. Bridges and

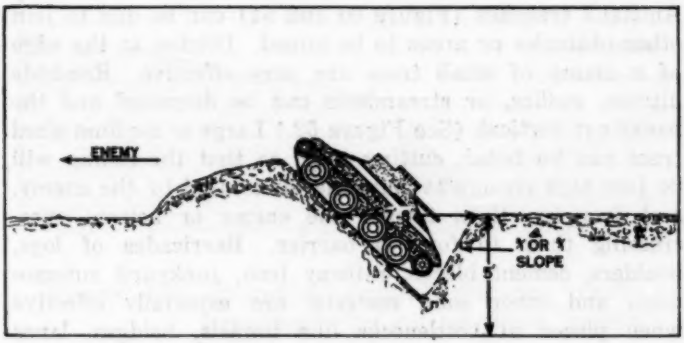

FIGURE 50.—Antitank trench.

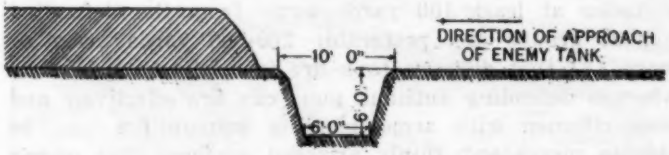

FIGURE 51.—Antitank trench.

culverts can be destroyed or barricaded (as directed by higher authority). Dams can be opened to inundate low ground, or dams may be built to deepen a shallow stream. Antitank trenches (Figure 50 and 51) can be dug to join other obstacles or areas to be mined. Ditches at the edge of a clump of small trees are very effective. Roadside ditches, gullies, or streambeds can be deepened and the banks cut vertical. (See Figure 52.) Large or medium-sized trees can be felled, cutting them so that the stump will be just high enough to belly the tanks used by the enemy, and dropping them toward the enemy or better, criss-crossing them to form a barrier. Barricades of logs, boulders, cement blocks, railway iron, junkyard automobiles, and other solid material are especially effective when placed at bottlenecks like tunnels, bridges, lanes through heavy woods, fords, and narrow valleys affording defilade and therefore likely to be used by enemy vehicles. (See Figure 53.)

Against armored cars having limited cross-country ability, single barriers of wire cable or loaded vehicles will suffice as road blocks. Strong boards set with spikes to catch bullet proof tires will also immobilize these vehicles. When practicable, road blocks should be covered by fire, and likely detours should be mined.

The ingenuity of the commanders of defending units must combine the materials and terrain at hand to create effective barriers. It is best to have the barricades or obstacles at least 100 yards away from the defending combat groups and preferably 200-300 yards away or more. At that distance tank fire is relatively inaccurate whereas defending antitank guns can fire effectively and even riflemen with armor-piercing ammunition may be able to pierce any thinly armored surfaces that enemy tanks expose to the defender's fire.

ANTITANK MINES

The advantages and disadvantages of mine fields were briefly discussed earlier. Before terminating the discus-

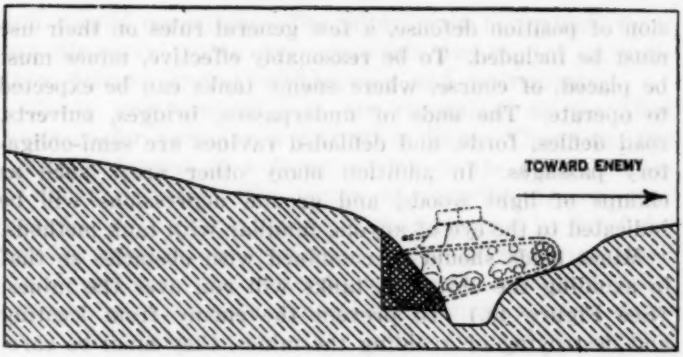

FIGURE 52.—Improving natural obstacles (gully or streambed) by cutting bank vertical to height of 4-5 feet.

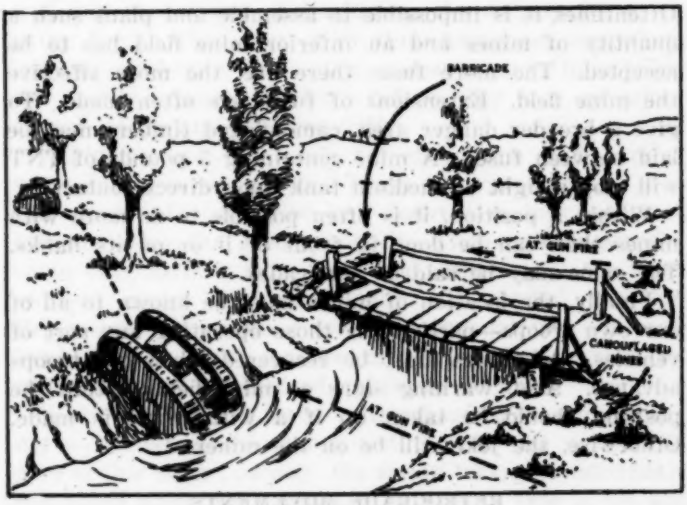

FIGURE 53.—Bridge barricaded and covered by fire. Banks on side of bridge mined.

sion of position defense, a few general rules on their use must be included. To be reasonably effective, mines must be placed, of course, where enemy tanks can be expected to operate. The ends of underpasses, bridges, culverts, road defiles, fords, and defiladed ravines are semi-obligatory passages. In addition many other areas such as clumps of light woods, and ground depressions will be indicated to the eye of anyone familiar with tank methods.

Mines fields should be combined with obstacles so that in avoiding the obstacles, tanks will run over the mines. (See Figure 49.) To prevent the enemy from locating and destroying or avoiding the mines, they must be carefully buried and camouflaged from both ground and air observation. Edges of woods, wire entanglements, and shell-torn areas make good places to conceal mines from aerial photography. To form a real barrier, mines are usually laid checkerboard fashion in two or three rows, with mines and rows of mines from 3 feet to 6 feet apart. Oftentimes it is impossible to assemble and plant such a quantity of mines and an inferior mine field has to be accepted. The more fuses there are, the more effective the mine field. Extensions of fuses are often made. To give a broader danger area, camouflaged timbers may be laid between fuses. A mine containing 5 pounds of TNT will stop a light or medium tank upon direct contact.

Within a position, it is often possible to do more with mines than can be done in front of it or on its flanks. The same may be said of barricades.

Finally, the location of mines must be known to all of our own troops—particularly those operating any sort of vehicles. All mines must be recovered when our troops advance. Also, warning signs on mine fields within the position should be taken up if a withdrawal is made. Otherwise, the joke will be on the miners.

RETROGRADE MOVEMENTS

It was indicated earlier that infantry also must provide for its antitank defense during retrograde movements

and special operations. The latter must be omitted from our discussion but a few comments are needed on antitank defense during withdrawals and retirements.

Tanks and armored cars are recognized as the ideal weapons for pursuing a retreating force. Therefore, the antitank defense of a force moving to the rear becomes a major problem. The action of covering forces, rear guards, and delaying troops is characterized by brief defensive operations on successive positions, employing small forces and great fire power to achieve the maximum delay without bringing on a general engagement at close quarters. Short thrusts by tanks are recognized as suitable means for permitting covering forces or rear guards to disengage and retire to the next phase line upon the route of retirement. Machine guns and artillery are the principal means of fire. Every effort is made to provide motor transportation for the speedy disengagement of covering troops. Thus it seems that motorized antitank guns fit well into the scheme of conducting the defense for a retiring force. They must alter their technique somewhat, however, and open fire earlier, endeavoring to immobilize the hostile armored vehicles before they can get close enough to do any effective firing.

Engineers are invaluable for demolition and barrier work during a retirement. There is no need to go into the variety of obstruction and destruction they can perform to delay the enemy pursuit. Time usually permits using only surface mine fields and obstacles on the most common routes the enemy may be expected to take. Bridge and other defile demolitions, inundations, and road blocks are the most common measures taken to slow up motorized and mechanized pursuing columns.

With that we will leave antimechanized measures during a retrograde movement and turn to the concluding part of this study; namely, the action taken by individuals and small units when attacked by tanks. This is the all-important question to John Doughboy, and one that he should be able to answer.

DEFENSIVE ACTION OF SMALL UNITS

Briefly stated, men armed only with rifles and automatic rifles should remain concealed (unless equipped with effective antitank ammunition), until the tanks have

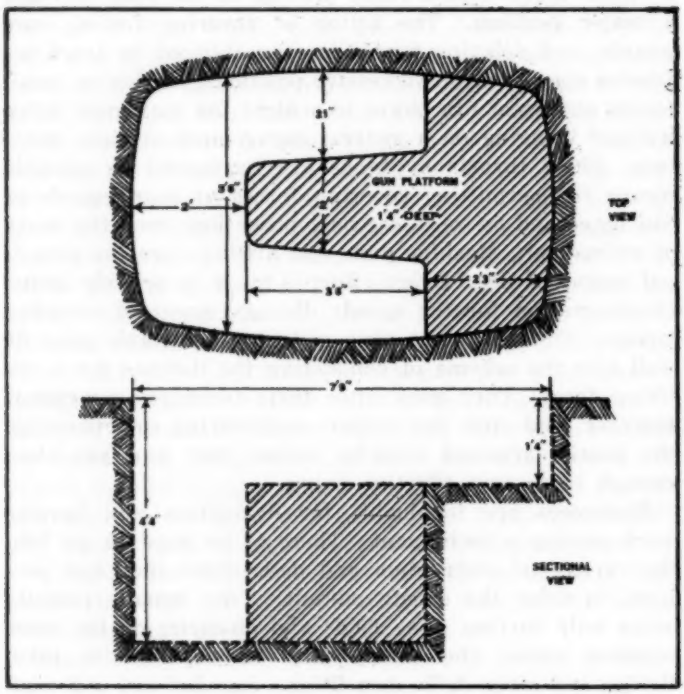

FIGURE 54.—Open standing machine-gun emplacement.

passed or are passing. If they are not under cover when the tanks first appear, they should immediately disperse and take cover. Cover may be a large tree, ditch, fox hole, trench, building, or other uncrushable shelter. A similar procedure should be followed by machine-gun elements. Light and heavy machine-gun units should hold

their fire if their position appears not to be known, and endeavor to avoid discovery. If well camouflaged they may easily succeed in this attempt. If the machine gun is in the open and seems to have been discovered, it should be left or dropped into a pit or trench to avoid being crushed, and the crew should disperse to any available cover. The tank having passed, the gun is re-manned.

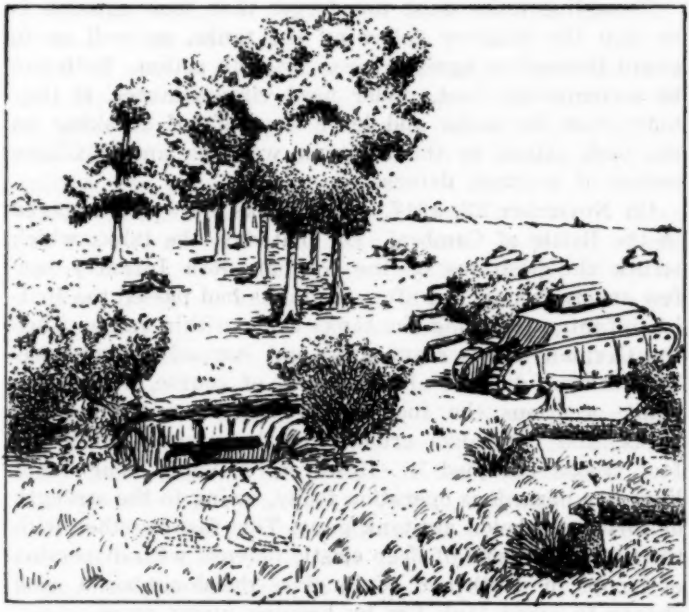

FIGURE 55.—Machine gun crew crouches in emplacement with gun tripod knocked flat until tank passes.

In most cases in a defensive situation a prepared gun position is occupied (Figure 54). In such a position greater safety for the crew results and more damage is done to the enemy if the crew stays where it is and keeps

firing until the tank is close. Then the gun tripod should be knocked flat to protect the gun, and the crew should crouch low to escape being hit by bullets or crushed if the tank runs over the emplacement. (Figure 55.) Fire is resumed after the tank has passed. Whenever small arms are used against tanks, the top and bottom armor, or eye slits, ball-mount openings, and tracks are the vulnerable points to aim at.

Front-line units must not forget that their mission is to stop the infantry following the tanks, as well as to guard themselves against losses by tank action. Both can be accomplished best, under most circumstances, if they hide from the tanks and leave the task of breaking up the tank attack to the antitank weapons and auxiliary means of antitank defense.

On November 23, 1917, Allied tanks were still engaged in the Battle of Cambrai. On that day, the tanks which struck the positions of the German 46th Infantry saw few enemy troops. But after the tanks had passed the British infantry following the tanks came within range. Then the German troops reappeared and stopped the advance. This scheme did not always work, of course, because on many occasions the foot troops were close behind the tanks, and the tanks cruised on the position until the foot troops occupied it. However, cruising along front lines is a hazardous operation today, owing to the strength of forward echelon antitank guns. This fact together with the present scheme of deep elastic defense with dispersion of troops in width and depth gives the doughboy a good chance to avoid tank fire by keeping under cover.

Certainly those who get panic stricken and run to the rear are going to be mowed down or run over.

To avoid wholesale panic and retreat, or meek surrender, combat troops must be made familiar with the limitations of tanks and how they are likely to behave. They should see tank demonstrations showing that:

(1) Tank crews cannot see or hear well.

(2) Tank guns have a limited field of fire and one gun can fire in only one direction at any given moment.

(3) This fire is only moderately effective even at close range.

(4) Many tanks have no flank or rear guns.

(5) Tanks can be stopped by various natural and artificial obstacles.

(6) Steel can be punctured by armor-piercing projectiles, and even caliber 0.30 AP bullets can be effective against thin belly armor, top armor, or track mechanisms.

(7) Tanks hunt for big game and care little about individual riflemen.

(8) A man in a deep fox hole, or men in gun pits and trenches are reasonably safe, and may even be run over by tanks without being endangered (at such times caliber 0.30 AP ammunition can be used to greatest advantage against thin belly armor).

If front-line troops understand these facts about tanks and have faith in the antitank defense protecting them, they will be able to nullify one of the cardinal effects of a tank attack, its moral effect. Then if they select and prepare their positions with a view to resisting tanks they will be in a fair way to suffer little when the attack comes.

With suitable weapons, proper utilization of antitank terrain features, and ingenious development of tank obstacles, all combined in a well-organized, coordinated, and controlled system of antitank defense, infantry no longer need feel helpless against mechanized attacks. Defending infantry will be able to meet tanks on an even footing, and oftentimes with the balance of strength favoring the defense.

CHAPTER 10

Antitank Defense in Foreign Armies

(AN INFANTRY SCHOOL STUDY)

In the World War, tank operations were a one-sided show with the Allies doing the directing. The French alone, in major and minor engagements, subjected the Germans to 100 tank attacks. By contrast the 5 local attacks made by German tanks (captured as well as German-made machines) were of scant importance.

As a result of this one-sided use of tanks, defensive measures against them were developed extensively only by the Germans. For two years they had to defend themselves against Allied machines. So, for two years they learned by experience—by trial and error. The results of that experience, though not accepted as entirely applicable today because of changes in tanks, weapons, tank knowledge, and fighting methods, is nevertheless the foundation for all the post-war studies made by European armies, and others, in developing their doctrines and means for opposing armored attacks.

GERMAN ANTITANK DEFENSE DURING WORLD WAR

The antitank defense methods adopted by the Germans may be divided roughly into three phases: (1) from September 15, 1916, to the summer of 1917; (2) from summer, 1917, to June, 1918; (3) from June 1918 to the Armistice.

During the winter of 1916-17, the following defense methods were adopted:

Ditches 12 to 18 feet wide were dug across roads—the Germans believing tanks would be able to operate only on roads.

Armor-piercing rifle and machine-gun ammunition was issued.

Special batteries of 77-mm or 55-mm pieces were placed in, or within 100 yards of, the front lines.

Modifications were made of the minenwerfer base plates to enable this weapon to fire with a flat trajectory.

It was found that ordinary light artillery batteries were more successful than the pieces put near the front, owing to the difficulty of concealing the latter and the impossibility of saving them if the position was penetrated.

By the summer of 1917, instruction was being given to improve marksmanship with antitank (light artillery) guns at moving tank targets. Moreover the new caliber 0.51 Mauser antitank gun was introduced. Meanwhile the passive measures adopted earlier were being improved.

From June 1918 to the Armistice—the third phase—antitank defense was an important part of all defense plans. The principal antitank features of defense methods were:

1. Choice of defensive positions in rear of streams.
2. Increased use of passive defense measures, such as mines, tank traps, obstacles, and flooded areas.
3. Increase in active defense measures by gun fire. Antitank artillery pieces were used well forward again.
4. Special antitank guns were organized in depth. In some sectors there was one gun for each 200 yards of front.
5. Artillery fired concentrations on tank assembly areas.
6. Especially designed antitank forts or centers of resistance were built in selected areas.

Here we see a development from haphazard, hastily improvised, uncoordinated measures to a well organized plan using natural and artificial obstacles in conjunction

with weapons of various calibers, including light artillery and special antitank guns.

The German high command learned that the moral effect of early tanks was more to be feared than the material effect. Antitank defense, therefore, became the concern of all combat units.

The German conclusions on antitank measures and the successful methods and means they used have become, as stated earlier, the foundation for all current developments in antitank defense. Many of these developments are progressing simultaneously in several armies or else are copied immediately once their efficacy is apparent. Our own principles outlined in Chapter 9 show the influence of the German methods and indicate the tenets that are rather generally recognized on antitank defense.

But, as was said in Chapter 8, European armies have gone considerably farther in this matter, as we shall see in the succeeding pages. Frequent parallels to our own methods will be noticed, besides others that are distinctly different. Particularly different are the means used to carry out the methods, and the importance attached to these means in the training and war plans of European armies.

GENERAL IDEAS ON ANTITANK DEFENSE

European views on the subject are well summarized by one German military writer in the *Militar-Wochenblatt* of May 18, 1936. "The tank has ceased being a special threat, having become a general threat. It has become part of the normal attack to employ tanks to open the way for the advancing infantry; therefore the defender possessing a strong antitank defense not only hits a severe blow to the tanks but also to the infantry which is thus deprived of their support."

A further expression of common beliefs comes from the military periodical *Sanct Christophorus* (Germany) of March, 1936. "Leadership in every great battle of the future will have to include plans for the defense against

massed armored vehicles seeking to deliver a decisive blow. Antitank weapons alone are not sufficient to ward off such a blow; there must be timely information through the work of all reconnaissance agencies, proper utilization of the terrain by all elements, and cooperation between all arms."

Controversy over the relative superiority of tanks and antitank guns, for the most part, has ceased. As one foreign writer expresses it "They constitute an even bet and the side making the better application of its weapon will win."

Also out of the controversial stage have come certain antitank principles now accepted by most armies and by most all military theorists. These are:

The primary defense against tanks is gun fire.

The utmost advantage must be taken of all natural obstacles.

Artificial obstacles and destructions must be prepared whenever time permits.

If practicable tank mines should deny the passages between obstacles.

Active and passive defense must be coordinated and prepared as complements to each other.

Antitank defense must be organized in depth as well as in breadth.

Tanks ordinarily should not be used for antitank defense, but when needed, are highly effective if properly armed and armored.

ANTITANK DEFENSE IN GERMAN ARMY

We have scanned the World War methods of antitank defense practiced by the German Army. Let us now examine more closely their present scheme of opposing armored fighting vehicles. Though they carefully avoid any rigid system, and admit that actual practical experience is necessary to clarify many opinions on technique and

organization, the Germans already have developed a practical antitank organization and effective methods of using it.

First we shall outline briefly the organization and equipment now in use together with the tentative improvements being considered. With that as a background we shall next examine the methods currently practiced and a few of the measures proposed.

ANTITANK WEAPONS

The basic weapon of the present antitank units is the 37-mm (1.45 inch) antitank gun made by the Rheinmetall corporation. It is illustrated in Figure 56. This gun has a muzzle velocity of 2600-2700 feet per second (equal to our standard caliber 0.30 weapons). The shield affords moderate protection against small arms fire, and when camouflaged serves also as concealment for the crew. The gun is low enough to be easily concealed. It can be traversed through 60 degrees and elevated from minus 25 degrees to plus 8 degrees. It weighs 660 pounds, and can be moved short distances by the crew. It is towed on and off roads by a cross-country, four-wheeled motor vehicle (Figure 57). A separate car is used to tow the gun limber. This gun will pierce 1-⅓ inches of armor at 600 yards if the impact is vertical.

The German infantry regiment has an antitank company (14th Company) of three platoons, each equipped with three 37-mm guns, making a total of nine guns in the company. The German infantry division has, in addition, a three-company battalion of these guns. There being three regiments in each division, a total of 54 antitank guns is found in the division. Considerable agitation exists to increase the guns in each company to 12 (4 platoons of 3 guns each), which would raise the division total from 54 to 72. It appears likely that this increase will be made. This number of guns, incidentally, is what General von Eimannsberger, the eminent Austrian authority on tanks and tank defense, recommends for the division. Various German military writers speak also of the

FIGURE 56.—German 37-mm antitank gun.

FIGURE 57.—German 37-mm antitank gun in movement.

corps antitank battalion, which indicates that corps and even army may be provided with these units among their special troops.

The antitank company is provided with enough reconnaissance cars and motorcycles to provide the means for mobility and control. Control and rapid communication is further insured by the signal squad which has a radio, a telephone, and an operating group for each of the three platoons and for company headquarters.

Each platoon has its own antiaircraft and local ground protection provided by a light machine gun with operating crew and car.

Besides this 37-mm gun, there are three other weapons advocated by many partisans of strong antimechanized means for the new German army.

These are:

1. A semi-automatic antitank rifle which can be operated and carried by one man (probably a 0.79 caliber). At least one of these weapons would be furnished each rifle platoon to give it local protection and to augment the 37-mm guns of the regimental antitank company.

2. A machine gun of adequate caliber (probably caliber 0.79 or 0.98), capable of delivering much more rapid fire at fast approaching tanks than is possible with the 37-mm gun. This is urged because in the duel between tanks and antitank guns, it becomes progressively easier for the approaching tank to locate its opponent and, despite difficult firing conditions, combat it effectively. Moreover, the numerical superiority of tanks attacking in width and depth may require each antitank gun to put out of action from a half dozen to a dozen machines if the attack is to be stopped. This is utterly impossible unless the defending guns can fire at an automatic or semi-automatic rate, because tanks averaging 12 miles an hour approach at the rate of 352 yards a minute.

3. A self-propelled gun (probably 47-mm (1.85 inch) or larger) for the mobile antimechanized reserve of corps and armies. This weapon would be the basic element of special tank defense units (or tank blocking units) charged

with the defense to be thrown out to meet a quick and maneuverable mechanized enemy. It is also recommended that one company of these self-propelled guns be added to the divisional antitank battalion of 37-mm motor-drawn guns.

Lieutenant Colonel Nehring wrote in a recent number of the *Militar Wissenschaftliche Rundschau* that the ideal antimechanized means of defense appeared to be:

1. Permanent assignment of light armor-piercing weapons such as 20-mm (0.79 inch) machine guns and 20-mm automatic rifles to the infantry rifle company, assigning to each platoon 1 machine gun and 1 rifle (horse or man traction).

2. Each infantry regiment, cavalry regiment, artillery battalion, etc.: 1 platoon of four tank defense weapons (37-mm) (horse-drawn or motorized).

3. Each infantry regiment: 1 company of 3 gun platoons (on auto carriages).

4. Each infantry division: 1 tank defense battalion divided into 2 companies like regimental company, 1 motorized pioneer company (with explosive and barrier implements including mines) and 1 machine-gun company (½ light, ½ heavy guns).

5. Each army corps: 1 tank pursuit battalion divided into 3 companies, each having 22 pursuit tanks, and 1 motorized pioneer company like that indicated in 4.

6. For army troops: barrage tank regiments subdivided into staff, signal platoon, 1 reconnaissance tank company, 2 tank defense battalions (as in paragraph 4 above), 1 motorcycle machine-gun battalion, 1 motorized pioneer battalion (with barrier implements), and also tank pursuit regiments.

So much for the ideal antitank defense weapons. Getting back to what actually exists, we have seen that there are two echelons of weapons for defense against tanks—the regimental antitank company and divisional antitank battalion. An examination of their employment in various circumstances, beginning with action on the march, follows.

GERMAN ANTITANK DEFENSE ON THE MARCH

Defense against armored vehicles is facilitated by reconnaissance and early warnings. Motorized units especially are capable of reporting early. Warning of the approach of armored vehicles is given to the threatened troops or to the commander of the march column by means of signals, messengers, or radio. This matter is regulated before the march is begun.

Tank defense guns are assigned the march columns, and especially to those on an open flank, and above all else—after the flanks are provided for—guns should be located at the beginning and end of the march columns. Roads leading into the flank of the march or from the rear can be blocked by engineers or the troops themselves by mines or other means. Specified armored vehicles, designated for defensive purposes, travel along the route of march, either in front or behind the march columns, or on parallel roads.

As soon as an armored vehicle attack is recognized or reported, all antitank weapons are made ready for action; foot troops take cover upon command of their leader; mounted troops and troops on vehicles endeavor to leave the roads in small groups. If this is not possible, they halt and try to block the road in the hostile direction by using vehicles or other means. Then they prepare to defend the obstacles. Some remain with the animals and others with the vehicles not used for blocking.

Normally the lower commanders must independently give the order to open fire.

The 14th Company (regimental antitank company) is intended primarily for the protection of its regiment against scout and armored cars and tankettes acting as reconnaissance vehicles, and, at the other end of the scale, against massed tank attacks. The divisional antitank battalion, however, is a reserve of the division commander which on the march must protect the division against a massed tank attack.

The 14th Company belongs in the regimental columns

of march. When the regiment acts as the advance or flank guard of the division the guns may be distributed as follows:

1 platoon (3 guns) is usually attached to the support, of which one gun squad is sent with the point, and one each to the head and tail of the support proper. The guns move by bounds in the interval between these advance guard subdivisions.

1 platoon is divided between the head and tail of the reserve.

1 platoon is with the motorized combat train of the advance guard regiment or regiments.

Oftentimes the antitank guns of the advance or flank guard regiment are pushed well forward or to the flank. Thus, in advance guard, the platoons may leap-frog forward, even going ahead of the point to occupy new positions. In the flank guard, one platoon may precede the point while the other two leap-frog forward to successive positions along the exposed flank.

When the regiment marches in the main body of the division, one approved method places one platoon at the head and one at the tail of the non-motorized elements, and one platoon with the motorized regimental combat train. This distributes antitank elements throughout the column.

Normally the division antitank battalion marches with the motorized units of the division. When a tank attack appears likely or hostile tanks are located, a part or all of the battalion may be sent to the threatened point.

When the division is an interior column, the antitank battalion often marches with one company at the head of the main body, and with the remainder of the battalion behind the third regiment,* that is, at the head of the motorized echelon. The battalion commander accompanies the division commander.

When the division is on an open flank, its antitank battalion must operate so as to protect that flank from armored attacks. Ordinarily the division will march in

* There are three infantry regiments in German division.

at least two colums with one of its three regiments forming the column on the exposed flank. The antitank battalion may then operate when threatened by enemy armored vehicles at 2 to 3 miles from this flank column, leapfrogging by companies from position to position. Positions are reconnoitered and occasionally occupied, but, basically, the battalion is kept mobile in order to meet the unexpected. The various positions occupied are predetermined from a map reconnaissance and other information indicating where attacks are probable.

ANTITANK GUNS IN DEFENSE

In defense, the 14th Company (antitank) must protect the main battle position against an armored penetration. There are two ways by which it may accomplish this task. The first is to hold the company in a centrally located position of readiness from where it can be thrown en masse to predetermined positions in the threatened part of the regimental area. Since a regiment may be defending a two-mile front, if fixed positions were occupied by each of the nine guns they would be spread so thinly that a massed tank attack coming through one part of the position would encounter negligible resistance. Therefore the partisans of holding the company mobile, contend that a divided company can accomplish nothing, and insist that to resist a hostile attack of massed tanks the defense too must be massed. They hope by means of pyrotechnic signals or radio to be sufficiently forewarned to enable them with their motorized equipment to reach positions early enough to combat the hostile machines.

The second method of using the 14th Company in defense is to attach the guns by platoons to the rifle battalions and to emplace them well camouflaged 300 to 400 yards behind the main line of resistance. They should not open fire until the tanks come within 600-800 yards. This method is declared by its partisans to be the only practical one because tank attacks will come too unexpectedly and too fast to enable defending guns to move

forward, occupy firing positions, and fire effectively upon the attacking machines before they get into the position.

This method is especially adapted to situations—

1. Where the sector is narrow;

2. Where obstacles canalize or restrict attacking tanks to a definite part of the front (or flanks);

3. When reserve antitank units are available to fill gaps and reinforce the regimental antitank guns;

4. When there is no observation into the hostile area, and the terrain favors tank operations, and it appears impracticable to bring guns forward from their readiness positions in time to be of use.

Which of these two methods is sounder cannot be determined. More than likely the answer is: "It depends upon the situation."

Turning to the divisional antitank battalion, we find that it is considered as a reserve of the division commander, and in defense has the mission of preventing a hostile penetration in depth or a breakthrough by tanks. It should be prepared to stop the hostile attack in front of the friendly artillery zone. If the entire battalion is held in reserve, it probably cannot be brought into action in time to accomplish this mission. Usually, therefore, one or two companies occupy positions in front of their artillery so as to cover likely approaches for hostile tanks, while the remainder of the battalion is held mobile.

Rocket signals sent up by front-line elements are generally favored as the means for alerting antitank elements.

ANTITANK GUNS IN ATTACK

In the attack the regimental antitank company must operate in close liaison with the assault battalions. The antitank platoons move by bounds from one firing position to another, keeping close behind the advancing foot troops. The division antitank battalion operates in the zone between the infantry and the artillery. It must displace forward from position to position ahead of the artillery.

Similarly, during deployment for the attack, Major

Zimmerman of the 5th Antitank Battalion believes that at least the leading rifle battalions should have antitank platoons with them because these battalions often will be subjected to harassing attacks by light tanks and tankettes. On the other hand, Major Von Schell of the German War College contends that the regimental antitank company should be held assembled while the regiment is deploying for attack and be moved so as to be available at the most probable danger point. Again, the situation will indicate which procedure to follow.

DELAYING ACTION

The great width to be defended by a division in delaying action causes antitank guns to be so far apart that enemy tanks and armored cars could easily break through at many points. One German authority proposes, therefore, that a platoon of the 14th (Antitank) Company be attached to each battalion, and that battalions distribute the guns to the outposts for the protection of infantry weapons in the first line of resistance.

The divisional antitank battalion must be employed in conformity with the terrain and possibilities for hostile armored attack. More often than not the battalion will have to be distributed in readiness positions.

In German maneuvers, antitank units are left with the last elements of a force moving to the rear. Having a simple towing arrangement for their guns they can withdraw and displace rapidly from one position to another.

OBSTACLES

Before leaving our study of German principles of antitank defense, their views on the importance and use of obstacles, mines, and tanks themselves as antitank means deserve mention.

German antitank doctrine strongly indorses the use of antitank obstacles wherever it is practicable to use them—whether natural or man-made. By judicious use of obsta-

cles they hope to render a large part of every divisional or regimental front difficult for, if not impervious to, tank attack. In the sectors not so protected they plan to mass the defensive fires and count on stopping a large percentage of the attacking vehicles. The Germans admit that time will often be lacking to do much in the way of preparing artificial obstacles, and the tactical considerations may preclude exploiting many existing obstacles. Indicative of their appreciation of obstacles and the difficulty of preparing them in time, are the large mechanical saws for felling trees that the French report have been used on recent German maneuvers. Since slashings are barriers to the movement of tanks, these machines are a distinct aid in preparing an antitank defensive position.

Mines are rated by many German military writers as the most effective and most convenient to use of all tank obstacles. Though mines may not destroy, at least they can be expected to immobilize a large part of the attacking machine by damaging their tracks. Admitting the great volume of mines required, it is contended that the transport requirements to deliver these mines would be less than the requirements to deliver enough munitions to the artillery for them to lay concentrations in lieu of the mine field barrier.

Major General Konigsdorfer, German Army, Retired, recommends that division engineers carry 5,000 mines in their combat train, that antitank companies and artillery batteries have an individual allotment of about 80 mines each, and that the remainder needed be carried by a division mine munitions train. He says about 20,000 mines would be needed for medium protecton of a 7½ mile front, and that 400 men (3 companies) would be required to plant them, at 50 mines per man. This would mean at least 8 hours work, probably more.

Another German author proposes a mine barrier of two mines per lineal yard, not all on the same line but on 10 or more lines in depth, as shown in Figure 58. It will also be noted in this illustration how antitank guns cover the lanes between mines.

As for tanks in antitank defense, present policy and current opinion both favor their use only to counterattack the hostile machines when they are out of control and have run into difficulties in the defensive position.

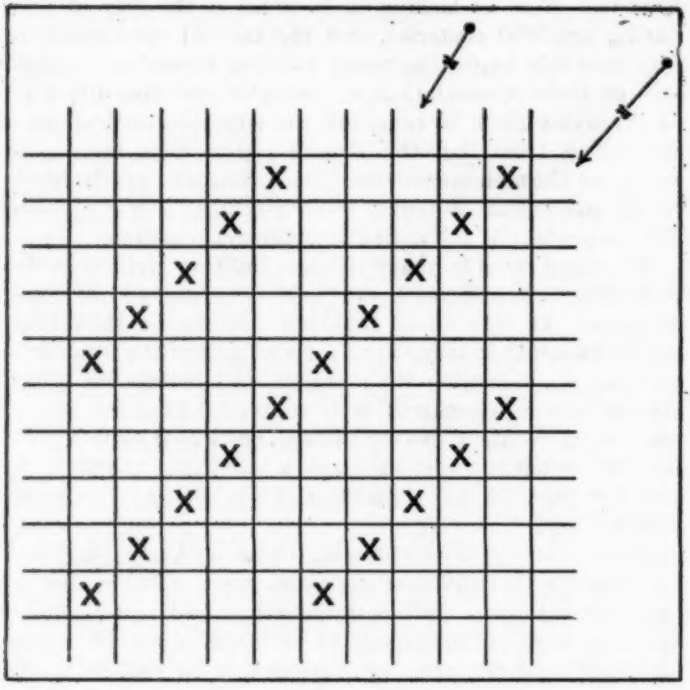

FIGURE 58.—Diagram of mines laid two per yard of front in a belt ten yards deep.

At other times they should ordinarily be held in reserve awaiting these favorable opportunities or critical moments when their intervention is imperative to avert disaster.

German infantry officers seem confident of their ability to cope successfully with the tank in the future. Infantry

is taught to stand its ground (light infantry avoiding tank fire by concealment), and fight the tank with full confidence in the efficiency of its defensive weapons.

FRENCH ANTITANK DEFENSE

West of the Rhine, we find the French giving antitank defense about as much attention as their German neighbors.

The March 1936 *Revista de Artigleria e Genio* (Italy) credits the French army with the following antitank weapons:

Caliber 0.51 machine guns capable of penetrating 0.59 inch of armor at 500 yards.

Caliber 0.79 machine guns capable of penetrating 0.79 inch of armor at 500 yards.

Caliber 1.18 machine guns capable of penetrating 0.59 to 0.63 inch of armor at 500 yards.

1.22—1.57 inch cannon capable of penetrating 0.98 inch of armor at 500 yards.

1.73—1.85 inch cannon capable of penetrating 1.57 inch of armor at 500 yards or 0.98 inch of armor at 1000 yards.

The two cannons listed last are apparently equipped with interchangeable barrels for they have two calibers—the larger for ground targets requiring a more curved trajectory, the smaller for flat trajectory fire against aircraft and probably also against tanks.

It is improbable that all of these guns are actually in service use. Several are probably experimental models. It is definitely believed, however, that the French have adopted the new Hotchkiss 25-mm machine gun. As briefly described by German sources, this gun is mounted on a two-wheeled, rubber-tired carriage with a split trail and with an armored shield for the protection of the gunners. (In these respects it is like the German 37--mm cannon. This gun probably weighs more than the German antitank cannon, however.) The gun is drawn by a light, cross-country tractor. (See Figure 59 showing armored tractor carrying 37-mm gun in trailer.) It has an effective

range of 3,400 yards, fires cartridges from clips of ten at the rate of 100 rounds per minute. It is reported to fire tracer bullets visible for 3,500 yards, but this statement is to be accepted with caution.

The French also have a caliber 0.51 machine gun, and a 37-mm gun of low muzzle velocity similar to our model of 1916 (shown in trailer of Figure 59).

One of the French experimental regiments has a new antitank organization. This experimental regiment has a company containing three antitank platoons, each with three of the 25-mm antitank machine guns described above, and also a platoon of two 81-mm mortars. This company is highly mobile, having tractive power for its weapons provided by the low silhouette, 3-ton *chenillette*, shown in Figure 59. This vehicle is patterned on the British Carden Loyd tankette.

Rifle battalions in this regiment have three rifle companies, and an accompanying weapon company. The latter consists of three machine-gun platoons, a caliber 0.51 machine-gun platoon, and a platoon having one 37-mm gun and two 81-mm mortars.

Thus it is seen that the new French infantry regiment has considerable potential strength to meet tanks: nine 25-mm machine guns in the regimental echelon, and one 37-mm gun and a platoon (4 guns) of caliber 0.51 machine guns in the battalion echelon.

The French have special combinations of arms for special missions; and, when required, form *groupes* bearing no resemblance to the set organizations habitually used in our service. The strength of auxiliary weapons in the battalion and regimental echelons of the French infantry has been greatly increased in recent years, so there is certain to be a strong complement of antitank weapons in both of these infantry units.

The French place great emphasis on the need for protection during the approach march against the air and armored elements of a modern army. To this end, well realizing the need for early information, which they learned at great cost in August, 1914, the French have

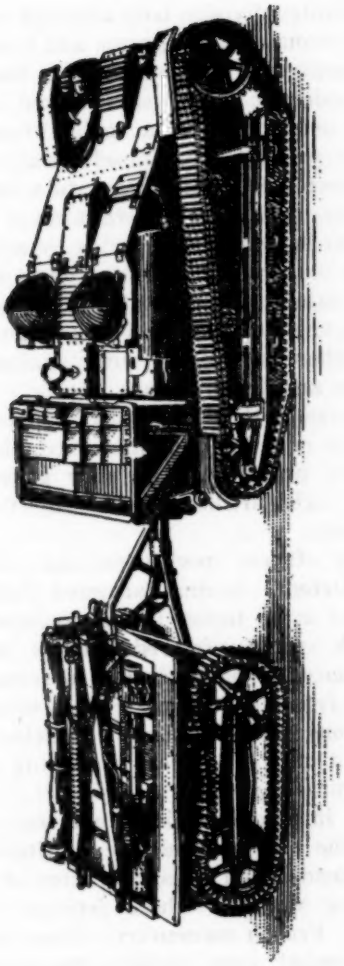

FIGURE 59.—French *Chenillette* (caterpillar) with trailer carrying 37-mm gun.

given their infantry division both armored cars and motorcycles for the reconnaissance group, and have provided the infantry regiment with a reconnaissance section of motorcycles with sidecars. Against armored vehicles their scheme is to send forward a mobile force (motorized reconnaissance groups, mechanized cavalry, infantry in motors, and tractor-drawn artillery) to a natural obstacle, preferably a stream line, and have it cover the movement of larger forces in rear against raids by armored fighting vehicles. Such units would operate a day's march or more ahead of the main force. Security detachments, in which engineers and antitank elements figure, go out 15 to 25 miles, and farther, to bar all routes against the advance of hostile tanks and armored cars.

Like the Germans, the French make advance guard elements strong in machine guns and antitank guns, and in addition always provide the advance guard commander with adequate light artillery to develop the hostile elements when met.

The infantry officers' pocket manual (*Aide-Memoire*) prescribes: "Defense against armored fighting vehicles must be assured at all times, just as antiaircraft defense. On the march, when armored attacks appear troops should: (1) conceal themselves and observe; (2) signal their approach from front to rear; (3) engage them with available weapons; (4) in case of vehicles restricted to roads, try to cut off their retreat by setting up barricades covered with gun fire."

At a halt or in bivouac, this manual says to barricade the outlets of the bivouac, and place antitank weapons to cover the barricades and possible routes of approach of armored fighting vehicles. These precepts are well carried out during French maneuvers. Thus, in all daylight halts in the combat zone, positive measures are taken against surprise attack by armored vehicles from any direction.

FRENCH ANTITANK MEASURES IN DEFENSE

In the general organization for the defense of a position, the army commander selects the defensive position taking full advantage of natural obstacles. Since the tank is rated Public Enemy No. 1, the importance of antitank missions is considered when allotting light artillery.

The corps commander prescribes artillery concentrations, and decides upon the use to be made of aviation and of reserve tanks.

The division is charged with the actual installation of antitank defensive measures. Using the theory of getting the tank into difficulties and then destroying it, every effort is bent toward utilizing existing obstacles—natural or man-made—improving their blocking characteristics, and establishing artificial obstacles and antitank mines in the gaps between the existing barriers. These obstacles are always covered by fire.

In addition to the use of antitank guns and artillery against enemy tanks, the French count also on using the medium or heavy tanks to counterattack against enemy tanks that have penetrated deeply into a defensive position. Such counterattacks are organized by the division commander and should strike the enemy tanks when they are disorganized and incapable of mutual support and also are away from the protection of their own infantry and artillery.

French Infantry Combat Regulations perscribe:

The Commander opposes enemy tank action:

1. by providing . . . artillery pieces for close accompaniment, detailed to use direct fire on tanks;

2. by using natural obstacles capable of retarding or stopping the advance of these machines;

3. by creating artificial obstacles (abatis, blocks of cement joined by rails, camouflaged tank traps, etc.);

4. finally, by having mine fields established, if the situation permits.

These regulations continue:

Tanks being unable by themselves to obtain a lasting

success, the first thing to be sought by the defending infantry is to separate the attacking infantry from their accompanying tanks. To this end, the fire of all arms is directed first upon the advancing riflemen to make them take cover. This accomplished, the hostile tanks are engaged by all the means of fire of the defending infantry. If the hostile infantrymen attempt to continue their advance, the fires are once more placed on them.

Thus we see that the chief mission of the defending infantry is to break up the attacking tank-infantry team by concentrating its small arms fire on the infantrymen and pinning them to the ground.

The French lay great stress on the value of light artillery direct fire as an antitank measure, which is understandable when it is recalled that about 88 percent of the tank casualties during the World War were caused by German cannon. Artillery intervenes in two ways:

1. By normal barrage fires and by prepared concentrations on tank assembly areas, using gas and high explosives.

2. By direct fire from antitank guns within the infantry positions, or direct fire from light artillery batteries or mobile reserve batteries quickly placed in previously reconnoitered positions to meet the attack.

Aviation seeks out and reports the presence of tanks so that mobile defense batteries can get into position; the planes then help to regulate the artillery fire. Aviation may also bomb or machine-gun the tanks when in assembly positions.

Engineers construct special works such as mine fields, concrete blocks, and other barriers. Many French officers believe that the answer to a modern mechanized force is a system of demolitions; that it is possible with a few engineers and several tons of explosives to paralyze such a force.

As for the employment in defense of the 25-mm antitank guns described earlier, we find that they are usually disposed singly, about half near the main line of resistance, and half echeloned to the rear up to a mile in depth.

Various types of troop trenches are being tested in the French army with a view to determining the profile, width, depth, and trace that *give the greatest amount of tank protection to the infantry soldier.* A deep trench with vertical sides not over two feet wide with a very irregular trace seems to give far more protection against tank fire and crushing action than the standardized types used on the Western Front. Moreover, these trenches use no parapet or parados but, for purposes of concealment, all excavated soil is carried away and dumped in woods or some other place where it will not be noticed from the air. As a result these trenches cannot be seen by approaching tanks until directly on them.

Our study of French ideas on antitank defense would not be complete without taking a look at what several of their leading authorities have to say on the subject.

In the *Revue d'Infanterie* (France) of June, 1935, General Barrard writes on defense against tanks in mobile warfare:

"There must be less rigidity in the defense of a position, especially in the concentration of infantry and artillery fires in front of a main line of resistance. Against rapid attacks, strong in tanks, the defense must be flexible and maneuverable, and must put uncertainty into the scheme of maneuver and fires of the attacker, endeavoring to surprise him with the unexpected. Clearly, if the defense can deceive the attacker as to the disposition and extension in depth of the real position of resistance, and thus escape an effective preparatory neutralization, it will regain the advantages of defending.

"The defense has little chance of acting effectively on tanks in the principal barrage zone bounded by the line of departure of the attacker and the main line of resistance of the defender, inasmuch as this is usually only about 400 yards in width. But if, before the attack, it were possible to extend backwards by 400 yards the principal barrage zone without changing the apparent contour of the position, that is, give the artillery and antitank guns a depth of 800 yards in which to engage

the tanks, then indeed the situation would change for the defense.

"Furthermore, within the position an efficacious maneuver would consist of an organization of interior fires.

"Finally, the ultimate maneuver of the defense is always the counterattack. By increasing the depth of the position, organizing tank obstacles in front of and within this depth, and strengthening the regimental reserve line, the counterattack would be easier to carry out. *But in the face of tanks it would be foolhardy to attempt a counterattack without tanks, and especially tanks with cannons.* (author's italics)

"The possible rapidity of penetration of an attack strong in tanks and the rapid maneuver of such an attack demands from the defenders a more rapid and flexible intervention of the reserves, reinforced by tanks."

General Barrard recommends:

1. Full exploitation of all water courses and other terrain features not passable by tanks and the use of artificial obstacles.
2. In zones passable by tanks to increase the depth of the position; not limit the artillery to one narrow barrage of fire; deceive the enemy on the real barrage areas.
3. Not to rely on the delaying action of outposts and delaying forces that are not based on impassable obstacles.
4. To give tanks to the defense.
5. To reduce the width of zones of action of units of the defense; to increase the depth of infantry cannon dispositions; or to augment temporarily the allotment of antitank and automatic weapons to defending units.
6. To facilitate the possible intervention of reserves.
7. To provide artillery and other rear elements with antitank guns.
8. To give infantry and particularly all command grades much more complete instruction in matters of defense (plan of fires, field fortifications, camouflage), and always give this instruction on the ground.
9. Familiarize all concerned with practical preparation of terrain, cover, and utilization of mine fields.

These ideas presented by General Barrard are fairly representative of current French opinion. Lieutenant Colonel Perre voices several additional ideas in the *Revue d'Infanterie* of December, 1935, in commenting upon General von Eimannsberger's *Kampfwagenskrieg* (Mechanized War). He refers again to a former study advocating successive positions in defense and its similarity to the proposal of General von Eimannsberger that infantry covering forces be pushed 1,000 to 1,500 meters in front of the first antitank barrage. He admits the value of successive antitank barrages with the reservation that this structure is determined by the characteristics of weapons in service. He also calls attention to the effectiveness of light artillery against tanks when using direct fire.

Major Poupel, influenced perhaps by the many mishaps his Renault tanks had with German artillery, strikes an optimistic note in the *Revue de Cavalerie* (France), September-October, 1934. "They (tanks) are not invulnerable. If we know in time, if obstacles can be placed, if we know how to maneuver in their presence and put our weapons in action against them, we shall beat them."

BRITISH METHODS OF DEFENDING AGAINST ARMORED FIGHTING VEHICLES

As in France, frequent reference is made in British Field Service Regulations to antitank defense, and in a large part the measures prescribed are similar to the French measures. The reason is apparent, since like the French, the British derive their methods from the German World War experience. In the British Army, however, antitank defense is confined largely to infantry companies, battalions and brigades (our regiment). This is quite unlike the French doctrine which makes antitank defense a responsibility of division, corps, and army. Ideas differ from both the German and the French in the greater importance accorded to tanks themselves as the means for combatting hostile tanks. Several years ago, when specific antitank guns were less developed, the British

placed tanks next to artillery as the most effective antitank means. The manual for Tank and Armored Car Training of 1927 in discussing the defense states:

"Whether tanks are held in rear or are made available for immediate counterattacks, it should be realized that they constitute the most valuable reserve in the hands of a commander for dealing with hostile tanks. * * *

(however)

"* * * The defending tank resources must on no account be so disseminated as to render them incapable of delivering a coordinated counterattack."

Since the publication of that manual both tank and antitank materiel have altered considerably in all armies and, no doubt, the present doctrine has been altered to conform. Yet even now the British expect their medium tanks to be a powerful weapon against hostile tanks.

For example, quoting British Field Service Regulations, 1929, " . . . if there is a likelihood of the advance guard encountering hostile tanks, he (commander of the force) will be justified in allotting tanks to the advance guard." Subsequently, discussing immediate counterattacks, we read, "An immediate counterattack by a few armored fighting vehicles will often achieve success. *Against hostile tanks a counterattack of this nature will often be effective,* but when large forces are engaged, the defending resources will usually have to be conserved for delivering a deliberate counterattack in considerable strength."

While considering the use of tanks as antitank means we might as well see how the British regulations prescribe their intervention. Returning to the Tank and Armored Car manual referred to above we find:

"The defending tanks should be disposed behind cover in an area in rear, covering the possible lines of approach between the natural and artificial tank-proof localities of the position so that they are able to engage the opposing tanks on a prearranged plan:—

i. First from behind cover with the minimum exposure to themselves, and

ii. Subsequently by moving out into the open, in suit-

able formations at full speed, to engage the surviving tanks, when the latter reach an area of ground which has been previously selected as being likely to place them at a disadvantage."

As for the infantry occupying the tank-proof localities, they should:

" . . . concentrate their efforts on breaking up the attack of the opposing infantry and should be trained to ignore a temporary penetration of the position by hostile tanks."

In general, however, tanks are not expected to be the mainstay of the antitank defense. Rather, this defense is provided for by the coordination of artillery and infantry fires in conjunction with tank obstacles. Moreover, British regulations prescribe that rear formations and columns as well as leading elements are allotted areas for which they are responsible, not only for their own protection but also for that of supply and maintenance units. In the forward areas antitank defenses are to be organized by the infantry brigade commanders (equivalent to our regimental commanders). Use will be made of natural and artificial obstacles, mines, infantry antitank weapons, and light artillery.

Artillery commanders will be responsible for organizing a second line of antitank defense in artillery areas. In addition, centers of resistance will be arranged in rear for the protection of roads, bridges, and other defiles. Any suitable artillery including antiaircraft guns and antitank units of infantry reserves may be used for these rear defenses. In the antitank instructions for artillery it is prescribed that as many pieces as possible will be sited in positions that give at least a short field of antitank fire to front and flanks. These pieces sited for antitank defense should always be able to carry out their normal missions.

Engineer troops are charged with the construction of obstacles requiring the use of explosives or special tools.

In these instructions for antitank defense we see that the infantry is responsible for the defense of forward areas and artillery for the rear areas, but no definite

provision is made for coordination as in French regulations, where responsibility is placed upon army, corps, and division commanders.

Within the infantry, however, instructions are specific on the general procedure to be followed in providing antitank defense. "Infantry Training," Volume II, 1931, prescribes that the antitank platoon of the headquarters company of the infantry battalion should be distributed in depth both in attack and defense, and that movement should be by bounds. The guns should not be committed to definite positions unless the ground restricts enemy armored fighting vehicles to definite lines of approach. The importance of coordinating antitank defense between neighboring units and between infantry and artillery weapons is stressed, but it is not indicated how this is to be done nor who is responsible for this coordination. Presumably the infantry brigade commander will do it.

The rifle battalion commander is charged with providing for the antitank defense of his area, this defense to be coordinated later by the brigade commander. Whenever possible infantry will be sited in tank-proof localities. The gaps will be covered by the antitank weapons disposed in depth.

" . . . The guns will be concealed and camouflaged and will remain silent until enemy tanks come within favorable range.

" . . . During an attack, the nature of the terrain will determine the dispositions of the antitank platoon. In open country it may be necessary to place a part of the guns under the command of forward rifle companies, the remainder being kept in mobile reserve at battalion headquarters. However, where the terrain offers a measure of protection it may be more advisable to concentrate the antitank guns in the zones favorable to tank action. In any case the battalion commander should endeavor to maintain the largest possible number of guns in reserve so that they will be immediately available to deal with a tank counterattack."

These summarized extracts from British regulations

of six years ago no doubt have been somewhat altered to fit the new antitank company of their machine-gun battalion. This antitank company consists of three platoons of four guns each. Mobility for these guns will probably be provided by a vehicle like the Carden Loyd tankette, which is the parent of the French *chenillette* illustrated in Figure 59. At present it is understood that light motor cars are being used. Such changes as have been made in antitank principles will more than likely be concerned with the employment of the antitank company as a unit instead of by platoons with rifle battalions. It is reasonable to expect that British ideas on mass use of antitank guns will be shaped along lines similar to the German doctrine.

Another influence on British antitank methods will be the type, or types, of guns finally adopted for combatting armor. The Vickers-Armstrong firm has produced several new guns. One is a 40-mm antitank gun using a shell with delayed action fuse reported able to penetrate $\frac{3}{5}$ inch of armor at 1,000 yards. Another is a 47-mm antitank gun. Figure 60 illustrates the 47-mm, and Figure 61 illustrates a Vickers-Carden-Loyd light tank carrying the 40-mm gun. Also, a new Universal-Vickers 50-caliber machine gun has been manufactured for antiaircraft and antitank defense. It has a two-wheeled mount and is towed by a truck or light tractor. Another recent weapon produced in England is an infantry cannon with two barrels, one of 25-mm for antitank defense and one of 70-mm for use against hostile infantry. It is also reported in the European press that the British have developed an effective antitank rifle of 0.68 inch bore which can be carried and used by infantry without requiring any cumbersome means of tranport.

According to German sources the British have adopted a new 40-mm gun as their heavy antitank weapon and a caliber 0.68 rifle as their light antitank weapon. The former will be issued four per antitank platoon (12 in company); and the latter, one per platoon (probably one per rifle platoon).

If these weapons become standard in the British army,

it is likely that the antitank company of the machine-gun battalion will be used as a mobile reserve of the brigade

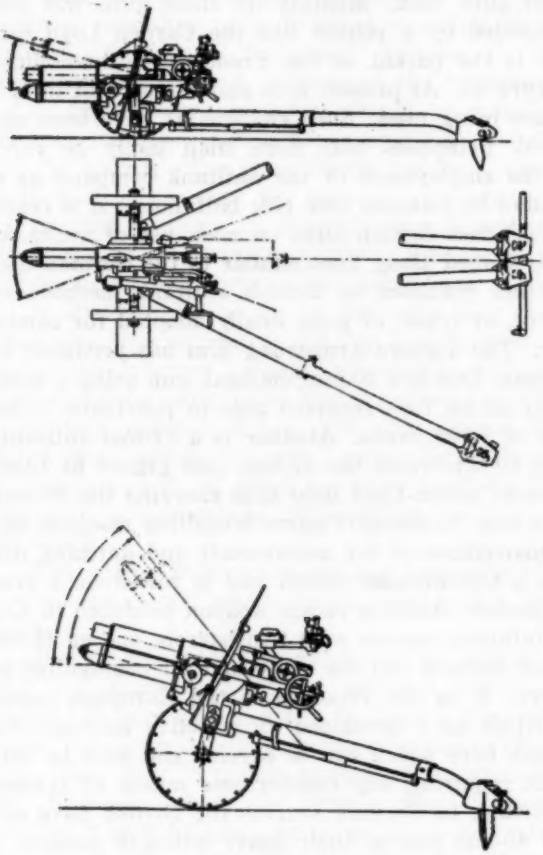

FIGURE 60.—Vickers (British) 47-mm gun in low position; plan view, and in high position.

(regimental) commander rather than in the more fixed defense of forward battalion areas. The latter will be pro-

tected in large part by the antitank rifles within the rifle companies.

Though the British seem to provide a less definite and coordinated system for antitank defense by gun fire than the Germans and French, their provisions for passive defense and protection by mines is definite and clearly

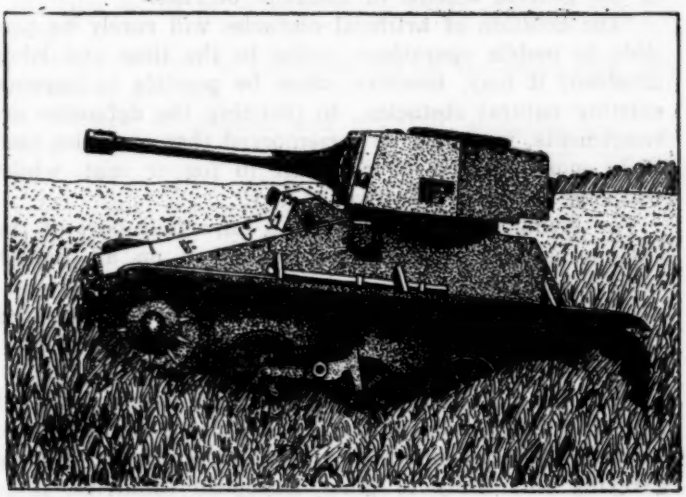

FIGURE 61.—Vickers-Carden-Loyd light tank equipped with Vickers-Armstrong 40-mm gun. This gun has a muzzle velocity of 2600 f/s maximum range of 7,437 yards, will elevate from — 10 degrees to + 20 degrees. It fires a 2-lb. projectile.

indicated. Again quoting "Infantry Training":

"Where natural tank-proof localities and obstacles do not exist, special arrangement for the protection of the infantry will be necessary. Use should be made of antitank mine fields; their exact positions must be carefully recorded, and the defenses so sited that the mine fields can

be kept under close small-arms fire by day or night. (This, no doubt, to prevent removing or disarming by hostile patrols.) A dummy mine field can be scratched by a few men with picks in a short time, and is difficult to distinguish from a live one on an aeroplane photograph; they may often be combined suitably with live mine fields in the general scheme of antitank defense.

"The creation of artificial obstacles will rarely be possible in mobile operations owing to the time and labor involved; it may, however, often be possible to improve existing natural obstacles. In planning the defensive arrangements, it should be remembered that obstacles tend to be more effective at night, or in fog or mist, whilst weapons are more effective by day."

The laying of mine fields is an important part of the anti-mechanized defense measures taken on all British army maneuvers.

Among the leaders and forward-looking exponents of British thought on mechanized and anti-mechanized matters no one is better known than Major General J. F. C. Fuller. His "Lectures On Field Service Regulations", II and III, though published in 1931 and 1932 contain much of value on the subjects we are here studying. Before carrying this study to other European countries, it is pertinent to quote extracts from these lectures. First, we should note his conception of antitank defense when the enemy's main force is not within striking distance.

"As regards antitank defense, the common conception is the use of static guns defending roads and approaches. This is all very well in its way, and an excellent system if the enemy can be induced to fall upon these weapons unawares. Though chance often plays a leading part in war, to rely solely on static guns is to gamble with fate. A better system would appear to be to organize antitank defense into three zones, namely, the air zone, the armoured car zone and the gun zone, the first two being about ten miles in width. This will mean, that when the enemy approaches to within some twenty-five miles of the protected position his movements will be observed.

* * * * * * * *

"Frequently armoured cars may well be replaced by motor cars with antitank weapons. In which case it would be an advantage for armoured cars, or tanks, to be held in reserve in two groups within the gun zone, ready to move out into the armoured car zone and attack an enemy in flank as he is attempting to break through the gun zone."

Next, we turn to his comments on the occupation of a defensive position.

"Outside of natural and artificial obstacles—such as deep trenches and mine fields, antitank defense may be organized in three ways:

(a) Tank counterattacks . . .

(b) Artillery: If the field batteries are well to the rear as they normally are, then a forward antitank position to which guns can be sent up directly enemy tanks are reported advancing must be reconnoitered. As this move will take time, the nearer the guns are to this antitank position the better.

(c) Antitank weapons, such as antitank machine guns, should normally be kept mobile, that is in reserve, and a number of alternative positions for each gun reconnoitered. If at the outset of an attack these weapons are in position, they may come under such heavy fire as to be difficult, or impossible, to shift. The positions selected should be such, that, when occupied, the fire of the antitank weapon will drive the enemy tanks into areas in which tank counterattacks can be launched against them."

General Fuller believes the trenches of the last war and the usual type of tank obstacle trenches to be too easily spanned by means of fascines, cribs, or other bridging devices. He recommends that antitank trenches take the form of rows of trenches, three or four feet deep, joined by V-shaped trenches. These trenches are then like long graves in which the tracks of the tank will be buried and thus "belly" the tank. Three or four rows of these graves laid out in diamond pattern would be a formidable obstacle. A zig-zag course would be the best way of crossing them,

but it would consume time and disrupt the attacking formation. (See Figure 62.)

SOVIET ANTITANK METHODS

The antitank methods of the Army of Soviet Russia differ markedly from those we have already considered.

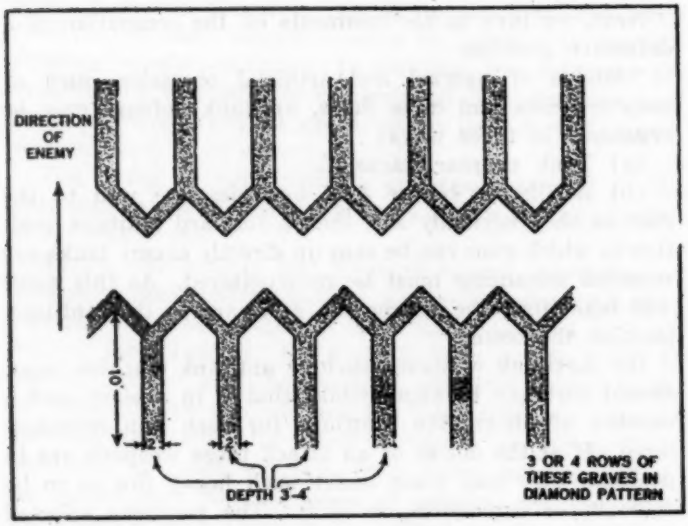

FIGURE 62.—Tank antitank trench. (Type proposed by Major-General J. F. C. Fuller.)

True, there is a certain general agreement, but on the whole, antitank methods in the Red Army are radical, although considered by many adherents of mechanization as the only practical system. Basically, it appears, the Russians plan to utilize tank against tank and not try to create and use special weapons for antitank purposes. (At present they expect to use light artillery.) Other armies admit the use of tanks to counterattack as a last

resort, and the British Army goes even further, but the Red Army goes the whole way and makes tank-versus-tank action a usual type of combat. Moreover, they expect aviation to play a big part in defense gainst mechanized attacks, not only as a reconnaissance agency but also as a weapon for direct attack. It is expected to use it also as a transport agency for carrying demolition detachments and security groups to threatened points, or even to points in rear of the hostile forces, to destroy establishments and materiel. These groups sent out on distant missions are trained to leave their air transport by parachute when it is impractical for planes to come down to the ground.

In Volume XII of The Infantry School Mailing List the Russian scheme of tank employment was outlined. It was seen that they consider the tank as a sort of jack-of-all-trades. This becomes more apparent when we examine their methods of combatting hostile tanks. Before looking at the role of the tank in antitank defense, a brief glance at the general scheme of providing anti-mechanized security is necessary.

On the march, security units are reinforced by enough artillery to resist one company of combat vehicles. For this purpose six or eight pieces are believed necessary. As reconnaissance and security units are not strong enough to hinder the penetration of combat vehicles, the Russians believe columns should be assigned antitank weapons. The artillery and battalion cannon are distributed among the columns and, to a certain extent, for the reinforcement of the advance guard. Likewise the attached division artillery is distributed among the echelons in the column; the guns forming the reserve of the regimental commander. The reserve of the division commander consists principally of tank units. In addition to antitank weapons, infantry also employs the grenade projector sections. During an attack by tanks the antitank weapons occupy suitable positions; the grenade projector sections remain in place or concentrate in the threatened direction, while the remaining infantry units retire under the pro-

tection of the antitank weapons, taking cover and building obstacles against the further advance of tanks.

In defense a tank battalion is customarily attached to a division assigned to the defense of a sector and is used in the "assault group," i.e., the counterattacking group of the division. The tanks are assigned to vital strong points in the defense system. Each group of from one to three tanks is assigned a narrow field of activity and then camouflaged and held in readiness to move out into previously prepared positions when the attack begins in order to engage the hostile tanks by fire.

In preparation for their intervention against an attack by armored combat vehicles, reconnaissance is made by all commanders of the tank battalion down to include the platoon commanders. This is done in close cooperation with the infantry reconnaissance. To make these reconnaissances worth while the intentions of the infantry "assault group" commander must be known by the tank battalion commander. All possible plans for tank counterattacks should be discussed, to include routes, direction, sectors, assembly points, and positions that afford the best field of fire. And special attention should be given to the terrain from which hostile tank attack can be expected.

The subsequent tank defense plan that is worked out between the tank battalion staff and the division staff should compel the enemy's tanks to move in the direction desired by the defense so that the defender can put them at a disadvantage, attack them by surprise, and overcome them.

The recommended procedure for a counterattack of tanks in combination with infantry "assault groups" follows:

The tank commander receives from the commander of the reserve (counterattack or "assault group") the information that the division has ordered the "assault group" to counterattack. The tank commander immediately alerts his battalion so that upon signal it automatically moves out. The signal for the tank battalion to attack must be given by the division.

The attack objectives should be first the hostile tanks, then the artillery, and finally the machine guns and the infantry itself. After the counterattack, the tanks assemble in a new, previously announced, reserve position.

An article by Alexandrow in the Russian *Motorisazja i Mechanisazja* discusses the action of tanks against tanks: "The formation for the attack should be on a wide front and not too deep. A narrow formation, at its best, can give only local results, and the crowding together of the attacking tanks will cause them to have greater losses. A formation in depth permits the forward echelons to be supported by fire from accompanying artillery tanks in the following echelons. Striking the hostile tanks simultaneously from different directions, or with closely following successive attacks from the same direction, should both be very effective. * * * " . . . instruction in the characteristics of the enemy's tanks with their advantages and disadvantages, should be the fundamental requirement for the training of tank troops."

In another issue of this periodical, author Slevaki writes that the occasions to use tanks against hostile armored vehicles in the next war will occur frequently if not daily. The defender will have the advantage of knowing the terrain. Even though he is weaker than the attacker, he should be able to pick the right time and favorable terrain (down grade for example) for an attack that will be effective against the hostile flank.

It is impossible in this study to examine the antitank defense methods and doctrines of all the European armies. Moreover, so little difference exists between their methods and those discussed that the attempt would be repetitious and fruitless. However, the weapons used for antitank defense vary considerably as do the units using them. For this reason and to present in concise form the antitank organizations and equipment already portrayed in these pages, Table III has been prepared. The data in this table are taken largely from published reports, but a part is based upon less reliable statistics appearing in foreign

military periodicals. These statistics, however, are believed to be sufficiently accurate to merit tentative acceptance.

With these ideas from the Red Army and the tabulation of antitank weapon organization we conclude the study of European methods of antitank defense. An effort has

FIGURE 63.—Solothurn 20-mm antitank gun in towing position. Weight 624½ lbs. Used experimentally by several armies.

been made to exclude as far as possible the measures which are designed specifically for the defense of the fortified frontiers prevalent in western Europe, and for the static warfare predicted by some authoritative writers as inevitable in any major European war. Even with that exclusion, there are many special factors in the strategical situation in western Europe that influence the antitank doctrines of the armies likely to be involved;

hence these doctrines are somewhat different from our own. An enumeration and discussion of these factors

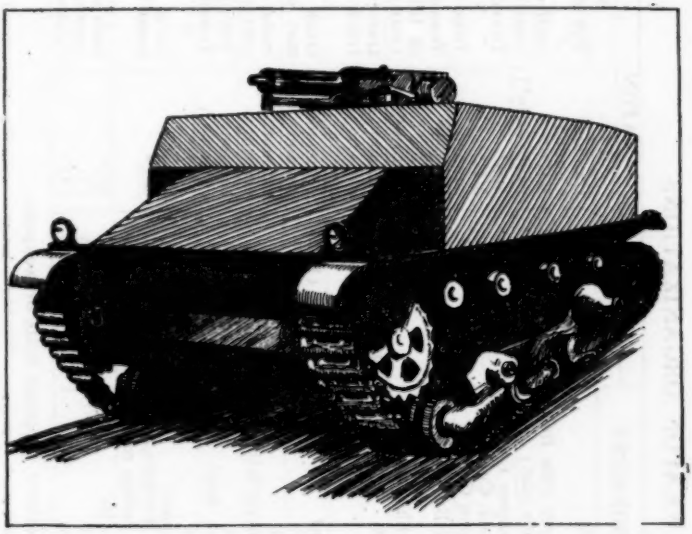

FIGURE 64.—Vickers-Armstrong armored tractor with 40-mm gun.

would be a study by itself. We should, however, bear in mind these facts while studying European methods.

TABLE III

ANTITANK WEAPON ORGANIZATIONS

ARMY	UNIT	ASSIGNMENT	WEAPON			
			No.	Cal. inch	Type	Traction
German	1 AT Co	Regiment	9(12)	1.45	Cannon*	Towed by car
	1 AT Bn of 3 Cos	Division	27(36)	1.45	Cannon*	" " "
	(MG plat)	(1 plat per rifle Bn)	(?)	(0.79)	MG*	(self-prop)
	(AT auto-rifle)	(1 per rifle plat)	(1)	(0.79)	(auto-rifle*)	(man)
French	3 AT platoons	Regt Weapon Co	9	0.98	MG*	Towed by tankette
	1 MG platoon	Bn Weapon Co	4	0.51	MG*	" "—?
	1 Howitzer squad	Bn Weapon Co	1	1.45	cannon	Towed in trailer
British	1 AT Co	Regt MG Bn	12	1.57	cannon*	Towed by auto
				(1.85)		or tankette
	(AT rifle)	(3 per rifle Co)		(0.68)	(auto-rifle*)	(man)
Russian	1 Arty Btry	Regiment	4 ?	3.0	cannon	tractor drawn ?
	Light Arty	Division	?	3.0	cannon	tractor drawn ?
	1 Tank Bn	Division	45 ?	?	cannon	
Italian	(1 AT Bn)	(Division)	(?)	(1.85)	(cannon*)	truck or pack
	Accompanying Gun Btry	Regiment	4	2.56	cannon	mot. or horse
Polish	1 plat Arty	Regiment	2	3.0	cannon	motor.
	(AT Gun Co)	Appropriation	made	but	no gun	adopted
Belgian	AT Btry	Regiment	8	1.85	cannon*	Towed by tractor
	AT Btry	Mech Cav Regt	8	1.85	cannon*	Towed by tractor
Japanese	1 AT Plat	Regiment	6	?	?	?
	1 Howitzer Sq	MG Company	1	1.45	cannon	horse
	1 AT Co	Pair of Hotchkiss guns on mobile mount	?	0.51	MG*	motorized
United States	1 AT Co	Weapons Bn	12	0.50	MG*	Carried in truck
	(1 AT Plat)	(MG Co)	(4)	(?)	(?)	(motor.)
	(1 AT Bn)	(Division)	(?)	(?)	(?)	(motor.)

Notes: 1. Words and figures in parentheses indicate proposed units or weapons.

2. Asterisk (*) after type of weapon indicates weapon with high muzzle velocity, i.e., 2,000 to 3,000 ft. second

3. The above data has been taken from many different sources. Their accuracy cannot be guaranteed.